



HAL
open science

Functional fit versus politics of scale in the governance of floodplain retention capacity

J. Guerrin, Gabrielle Bouleau, F. Grelot

► **To cite this version:**

J. Guerrin, Gabrielle Bouleau, F. Grelot. Functional fit versus politics of scale in the governance of floodplain retention capacity. *Journal of Hydrology*, 2014, 519 (C), pp.2405-2414. 10.1016/j.jhydrol.2014.08.024 . hal-01094417

HAL Id: hal-01094417

<https://hal.science/hal-01094417>

Submitted on 12 Dec 2014

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

1 “Functional fit” versus “politics of scale” in the governance of 2 floodplain retention capacity.

3 Authors

4 Joana GUERRIN^a, Gabrielle BOULEAU^b, Frédéric GRELOT^c

5 a/ Corresponding author - IRSTEA (French National Research Institute of Science and Technology for
6 Environment and Agriculture). UMR G-Eau. 361, rue J.F.Breton. 34196 Montpellier, France.
7 joana.guerrin@irstea.fr

8 Phone: +33 (0)4 67 04 63 23; Fax : +33 (0)4671664.40.

9 b/ Irstea, UR ADBX Aménités et dynamiques des espaces ruraux, F-33612 Gazinet Cestas, France.
10 gabrielle.bouleau@irstea.fr.

11 c/ IRSTEA. UMR G-EAU. 361, rue J.F.Breton. 34196 Montpellier, France. frederic.grelot@irstea.fr.

12

13 Abstract

14 After major floods occurred in 2003 on the Rhône River (France), the State and local authorities
15 created a new institution at river level, in order to tackle flood issues at a supposedly more functional
16 scale. Called *Plan Rhône*, this new partnership combined several policy sectors and several
17 administrative levels, with the aim of developing the river territory and preserving floodplain retention
18 capacity. The plan included a floodplain restoration project. However, after five years of negotiation,
19 the project was finally abandoned. In this article, we analyze the drivers behind the failure to preserve
20 floodplain retention capacity by focusing on scale issues, using two theoretical frameworks: the
21 concept of “functional fit” between the scale of ecological issues and that of the institutions in charge
22 of those issues, and the concept of “politics of scale” in which scale results from historical processes.
23 We conclude that the scaling of an issue results from history. It legitimates a specific point of view
24 and hampers alternative ways of seeing reality at other scales.

25 Keywords

26 Flood; Public Policy; Politics of scale; Functional fit; Floodplain restoration; Rhône; France.

27

28 **1. Introduction**

29 In many western countries, levees are no longer considered as an appropriate solution to flood
30 management. Past events have shown that failure of these infrastructures cannot be completely
31 avoided. Indeed, in cases of flooding, the presence of levees may serve to exacerbate the problem,
32 causing damage and injury that could have been avoided had they not been in place. The robustness of
33 dykes is questioned in the context of climate change, which may modify the very flood regime they
34 were designed to protect against. The existence of levees fosters land use change, because inhabitants
35 see them as a safety net. The socio-ecological processes leading to the construction of levees have
36 proved to be unsustainable in many places. The multiple factors explaining these dynamics can be
37 summarized as follow. Lowlands liable to flooding are fertile and easily accessible from river or road
38 transport channels, therefore conducive to economic development. However, each flood is a threat to
39 human life, induces business slowdown, and is harmful to perishable goods located at water level.
40 Building levees around lowland will extend the operation period from one overflowing flood to
41 another, and increase lowland profitability by removing water constraints. Despite this, water
42 embankments result in higher flood levels due to narrowed beds and there being less space for the
43 water to occupy, which in turn increases peak flood flows. From an environmental viewpoint, levees
44 will prevent alluviation, groundwater recharge and proper development of a number of lifecycles.
45 Although statistics from past floods help design a levee so that it is quite likely to resist previously
46 known floods, the probability that such floods will occur changes over time. When poorly maintained,
47 levees will fail. In urbanized catchment areas, land sealing and additional levees will ensure quicker
48 water transfer to water courses and higher flood peak (Scarwell and Laganier, 2004). Lastly, climate
49 change may induce more frequent extreme hydrological episodes, with a higher probability that water
50 will flow over existing levees, or even destroy them. So dyke-raising is never enough.

51 Consensus has grown among water scientists that sustainable flood management requires “making
52 space” for water by increasing retention capacity of floodplains (Maltby, 1991; Moss and Monstadt,
53 2008; Warner et al., 2013). Retention areas are supposed to strengthen existing systems of flood
54 protection, and thus the security of populations and goods exposed to floods (Montz and Tobin, 2008).
55 Several experts recommend restoring the retention capacity of floodplains, i.e. to remove levees that
56 protect non-urban areas, or to lower their protection potential by creating spillover. This is promoted
57 for two supposed complementary objectives: development of flood retention areas and renaturation of
58 floodplains. For the purpose of this article, we will use the term “floodplain restoration” to grasp this
59 twofold idea. Renaturation is the practice of protecting environmental services found in floodplains,
60 such as aquifer recharge, reduction of flood velocity, and natural habitats (Dufour and Piégay, 2009).
61 However, this scientific consensus has proved to be very difficult to implement in practice. Political
62 scholars explained this gap between theory and practice by institutional and governance related
63 constraints to implementation (Moss, 2004; Tobin, 1995; Warner et al., 2013; Wesseling et al., 2012).

64 One attempt to adapt institutions and rules in order to foster floodplain restoration occurred in the
65 Rhône valley. However, the new governance did not meet the goal of increasing floodplain retention
66 capacity. It did not succeed in removing or lowering existing levees. Instead the height of other levees
67 was further raised. In this paper, we try to understand why the governance of the Rhône floodplains
68 failed to reach its ecological goals although participants explicitly sought a “functional fit”. Our
69 central argument is that the correct scale of governance in this field cannot be defined as a fixed value
70 from the outset. It is rather defined through political processes. This is because there is a multitude of
71 uncertainties and controversies surrounding the scaling of key issues, including a variety of different
72 knowledge claims and interests one can only examines when they operate at work. Some critical
73 geographers characterize such situations as a “politics of scale” (Brenner, 2001; Buizer et al., 2011;
74 Moore, 2008; Swyngedouw, 2004). Their analytical tools help us to understand the lack of legitimacy
75 of rationally designed institutions.

76 The paper is organized as follows. In Section 2, we present the analytical tools of two theoretical
77 approaches dealing with scale issues for natural resource management: the “functional fit” and the
78 “politics of scale”. We then explain the methodology we used to apply them to our case. In Section 3,
79 we present the case of the Rhône floodplains (France) and the objective of *Plan Rhône* as a new
80 institution dealing with flood risk at the level of the river. In Section 4, we analyze the failure of *Plan*
81 *Rhône* objectives to preserve and increase floodplain retention capacity in two steps: (4.1) the
82 interaction between *Plan Rhône* and “functional fit” issues, and (4.2) *Plan Rhône* as the product of
83 “politics of scale” in which it is inserted. We conclude by discussing the interests of both bodies of
84 literature and proposing improvements regarding flood management and scale issues.

85 **2. Addressing the governance of floodplain restoration in terms of** 86 **“functional fit” or “politics of scale”**

87 For the purpose of this paper, we define scale as the spatial scope and the resolution used by any actor
88 to represent a process having spatial dimensions. Individuals choose to address an issue at a specific
89 scale according to their points of view and beliefs. Institutions, such as political mandates, economic
90 sectors and administration levels, are vehicles for spreading specific beliefs on territories, populations
91 and socio-ecological problems at specific scales they claim to be legitimate. Restoration of floodplains
92 involves socio-ecological processes which are differently perceived by decision-makers according to
93 their roles in policy-making or the economy. From their diverse points of view, they apprehend these
94 processes at different scales. The governance of floodplain restoration must encompass multiple scales
95 (Gregory et al., 2011; Molle and Mamanpoush, 2012; Wallis and Ison, 2011). It requires the
96 collaboration of many stakeholders acting at different levels and the adjustment of the rules that were
97 forged for living with levees. Systems whereby towns benefiting from floodplain restoration pay
98 compensation to those losing out are hard to implement (Erdlenbuch et al, 2009). Scale issues can be

99 critical in respect of the success or failure of floodplain restoration projects. To highlight this
100 challenge we identified two strands of literature that are not water-specific, but seem relevant to
101 address this institutional issue related to flood management: one focuses on the “functional fit”, the
102 other on the “politics of scale”.

103 *2.1 “Functional fit”*

104 Some scholars have addressed the issue of scale and environmental management as one of a
105 “functional fit” of institutional design (Ekstrom and Young, 2009; Folke et al., 2007; Young, 2002).
106 They argue that restoring ecological functions is a matter of reforming institutions and rules to make
107 them more ecologically functional. They provide a methodology to check whether regulations and
108 stakeholder jurisdictions are consistent with the protection of a natural resource at stake.

109 This approach is rather normative. It seeks to provide decision-makers with recommendations for
110 sustaining ecological processes. Ekstrom and Young (2009) have aimed to assess how “the nature,
111 functionality, and dynamics of a specific ecosystem” are taken into account by the institutions that
112 influence it. In line with other institutionalist scholars working on environmental issues (Norgaard et
113 al., 2008; Ostrom, 2009), they consider that mismatches between socio-ecological processes occurring
114 at specific scales and institutional settings dealing with other scales may lead to failures to sustain
115 natural resources. They have defined this question as a problem of “functional fit”.

116 From this perspective, institutionalists have noted several criteria for successful natural resource
117 management. They notably advocate:

- 118 - Identifying all factors affecting or being affected by the natural resource (Cash et al., 2003);
- 119 - Defining clear boundaries of the ecological system to prevent misfits (Ekstrom and Young,
120 2009; Ostrom, 1990);
- 121 - Establishing a set of regulations with clear-cut and effective compliance mechanisms (Young,
122 1989).

123 Applied to the protection or restoration of floodplain retention capacity, this approach consists of
124 listing the factors affecting flood patterns (increased runoff due to more impervious surfaces, higher
125 water levels due to embankments, lower water levels due to retention, more extreme flows due to
126 climate change, and levee failures) and activities threatened by floods. Focusing on the hydrological
127 nature of floods, institutionalists generally recommend addressing the problem at the scale of the
128 watershed. Seeking a “functional fit” calls for the creation of rules that are consistent with the
129 restoration of floodplains. We shall first consider the question of consistency and then address the
130 plurality of factors affecting the system.

131 In the context of multi-level governance¹ (van Tatenhove and Leroy, 2003), institutionalists no longer
132 recommend designing a unique institution. They postulate that institutions and stakeholders situated at
133 different scales must coordinate their actions and rules to govern ecological systems (Cash et al.,
134 2006). They draw the analyst's attention to the set of binding regulations ruling the issue at stake and
135 recommend checking its consistency. Rules are considered inconsistent when two regulations
136 contradict each other and there is ambiguity regarding which prevails (Cash et al., 2006). Reviewing
137 all rules requires a systematic approach. E. Ostrom dealt with multi-level governance considering that
138 "all rules are nested in another set of rules that define how the first set of rules can be changed (...).
139 Changes in the rules used to order action at one level occur within a currently "fixed" set of rules at a
140 deeper level."(Ostrom, 1990:51). This nested approach assumes that the precedence of some rules over
141 others do not depend on cases. It corresponds to situations where rights are ascertained and the
142 boundaries of the resource well-defined (Sax et al., 2006:310-320). In European countries, where laws
143 are based on codes, those codes are used as a basis for systematic reviews. With this approach, the
144 civil code prevails over regional legislation, which in turn has power over local arrangements.
145 Sustainability requires an adjustment of the rules at all relevant levels, so that existing stakeholders'
146 rights and rivalries do not hamper environmental functionalities (Gerber et al., 2009; Varone et al.,
147 2013)².

148 Ostrom initially considered that defining boundaries and identifying factors affecting the system could
149 be achieved by providing more information about the system (Ostrom, 1990). Her followers have been
150 less optimistic. They have tended to distance themselves from the notion of "functional fit" for dealing
151 with complex environmental issues known as "wicked problems". These problems involve a large
152 diversity of social groups. They have numerous and conflicting definitions, solutions that can create
153 problems for others, and no rules for closing the debate (Lach et al., 2005; Rittel and Webber, 1973).
154 Restoring floodplains is arguably a wicked problem because the development of floodplains is an
155 uneven historical process resulting in much diversity among riparian populations. Removing levees is
156 a solution that creates other problems. In case of controversial assessment of flood behavior, only the
157 occurrence of floods can close the debate, which does not happen on demand. Cash et al. (2006) admit
158 that ignorance and diversity are two cross-scale challenges. The former arises because "ignoring cross-
159 scale dynamics within spatial and temporal dimensions is common". The latter refers to "the incorrect
160 assumption that there is a single, correct, or best characterization of the scale and level challenge that
161 applies to the system as a whole or for all actors". Moving away from the objective of a perfect

¹Government refers to State-centered public action. Governance means multiple stakeholders participating to the decision process. Institutionalists consider that "one important aspect of governance is the role of "institutions": the formal and informal rules that provide the framework for the behavior of human beings" (Pahl-Wostl, C. et al., 2008. The importance of social learning and culture for sustainable water management. *Ecological Economics*, 64(3): 484–495.)

² As one reviewer wisely noted, rules have no power by themselves. They are enacted by actors who may wield power by drawing upon rules. The institutionalist approach tends to consider that all rules are enacted.

162 institutional fit, these authors and others (Biswas, 2004; Folke et al., 2007; Mitchell, 2005; Moss,
163 2012; Moss et al., 2009; Pahl-Wostl et al., 2008) recommend identifying such challenges and
164 managing them through ad-hoc measures. Somehow they admit that stakeholders involved in wicked
165 problems should have some leeway for adaptation that cannot be grasped through institutional design.

166 *2.2" Politics of scale"*

167 Proponents of the "politics of scale" approach have a more radical view: they consider that
168 institutions, however well-crafted, never fully fit a function or a position on a scale. These critical
169 geographers and political scientists are reluctant to position institutions on a scale because of political
170 implications, which they refer to as the "politics of scale" (Brenner, 2001; Molle, 2007; Rangan and
171 Kull, 2009; Swyngedouw, 1997). They consider that the argument "regional regulation prevails over
172 local arrangements" is a claim for regional hegemony rather than a fact (Jessop et al., 2008) and
173 assumes that the local is subject to the region's power. This should never be taken for granted because
174 it depends on the legitimacy of the regional power on a specific issue. Legitimacy, as everything that
175 deals with social life "is process-based, in a State of perpetual change, transformation and
176 reconfiguration" (Swyngedouw, 2004:26). For the same reason, the spatial scope of institutions is not
177 set once for all. These authors do not consider individuals and collective actors as "stakeholders"
178 because they argue that participants of social movements and members of institutions change their
179 perception of stakes in the process of interacting with others. The term "actors" better grasps the social
180 ability to play with different scales in order to frame the meaning of the issue and the claim for
181 regulation at different levels (Kurtz, 2003). Attention is drawn towards potential ambiguities in the
182 definition of institutional responsibilities, in particular in cases of "trusteeship" defined "as the intent,
183 which is expressed, by one source of agency, to develop the capacities of another" (Li, 2007:5).
184 Critical political ecologists further contend that hierarchy does not exist once and for all in nature
185 either. They consider that positioning actors on the ecological scale is a matter of knowledge claims -
186 only valid within a specific range of assumptions - rather than a fixed law (Buizer et al., 2011;
187 Forsyth, 2003; Rydin, 2007).

188 For these authors, it is vain to fit institutional scales into ecological ones, because neither category is
189 fixed. More can be learnt from historical accounts of how institutions became legitimate to represent
190 and tackle some socio-ecological problems at specific scales. This can explain which information was
191 produced and which elements were ignored, leading to specific beliefs. In this approach, scale is no
192 longer a category of analysis, but a category of practice (Moore, 2008). It is not something to be
193 rationally crafted, but the result of historical conflicts and cooperation between actors. For these
194 scholars it is not the role of science to design adequate institutions, but rather that of politics.
195 Historical analysis allows for identifying:

196 - The political reasons why some actors rescaled their perception of a problem;

197 - How institutions spread beliefs inherited from past policies and power relations, which
198 distort actors' perceptions.

199 These elements are place-specific. They are crucial to understanding why institutional models that
200 were successful in one place failed when applied in a different place.

201 Our take on the “functional fit” and the “politics of scale” bodies of literature requires articulating both
202 frameworks. We argue along the “politics of scale” that the discourse of “functional fit” is a political
203 claim. We believe that several functionalist definitions of flood issues compete in the political arena,
204 each of them best fitting one specific scale. Actors engaged in one definition try to rescale the issue to
205 fit their cause. However, we will argue that rescaling strategies are constrained by past policies and
206 longstanding beliefs spread by institutions.

207 Our case would appear to be an accurate example of this phenomenon. Since major floods occurred in
208 2002 and 2003 on the Rhône River, State officers dealing with flood management have tried to move
209 from a centralized flood policy to a river-basin level governance of this issue with the aim of
210 preserving the floodplain retention capacity and if possible to enhance it. They set up a strategic and
211 financial contract between all the actors involved in flood issues near the Rhône River, called *Plan*
212 *Rhône*. They inscribed the floodplain restoration objective of *Plan Rhône* in several legally binding
213 documents¹. However, at the end of the process some higher dykes were built and no one was
214 removed. The floodplain lost some retention capacity. The decentralized flood governance may have
215 proved effective in some dimensions but it failed to achieve its main target. It must be noted that the
216 effectiveness of governance is multi-dimensional and what may appear as a failure in one dimension
217 may be a success in another (Young, 1994). However, this conclusion is not ours, but that of State
218 officials working in *Plan Rhône*, the institution purposely crafted at river basin level to develop a
219 sustainable floodplain. Our analysis first adopts the point of view of these actors and seeks to identify
220 which institutional factors of success were missing for their goal using the “functional fit” literature
221 (clear-cut boundaries, knowledge of interdependence factors, compliance mechanisms). Second, by
222 elaborating on the “politics of scale”, we explain why State actors were not able to see that such
223 factors were missing from the beginning, and why despite their blindness they remain legitimate
224 spokespersons for local actors.

¹ This objective was inscribed in 2005 within a State-Regional Plan Contract (CPER), funded partly through European Funds (European Regional Development Fund). This objective was included in the Water Development and Management Plan defined at the level of the watershed (SDAGE). The SDAGE reinforces the binding character of this objective since local urbanization plans (at the municipal level) must be consistent with SDAGE objectives.

225 **2.3 Methodology for studying the governance and the scaling of flood issues in the Rhône** 226 **valley (France)**

227 Our methodology is based on what actors say and write. We analyze their discourses in order to
228 identify how actors understand flood issues in terms of system boundaries, impacting factors and rules.
229 We seek to identify at what scale actors apprehend flood issues in the Rhône valley, at what scale the
230 information they can rely on is represented, and what their beliefs and understanding of flood
231 governance are.

232 Our empirical data came from interviews with actors engaged in flood governance on the Rhône River
233 during the 2003-2013 years and the literature they produced (expertise, information provided to the
234 general public) on floods in general and on the Rhône River in particular. Between 2009 and 2013, we
235 conducted and transcribed 62 semi-structured interviews with *Plan Rhône* participants, central and
236 local State officials and elected representatives, as well as opponents to the floodplain restoration
237 project (inhabitants, associations, local governments). In order to follow changes in problem definition
238 and issue rescaling, we systematically compared how the proponents defined and mapped the problem
239 of flood at different periods, in interviews and public documents. We related these definitions and
240 scales to what actors believed, what solutions they promoted and the factors of success or failure they
241 identified.

242 In a second step, we sought in second hand literature the origin of what *Plan Rhône* actors *a posteriori*
243 considered as their own wrong beliefs. We looked for beliefs inherited from past policies and power
244 relations, which influence actors' perceptions. For this purpose, we consulted literature written by
245 historians and geographers on the history of the Rhône and its infrastructure. We also examined how
246 public projects were justified in archives relating to the construction of a dam and dykes located near
247 the floodplain earmarked for restoration.

248 **3. Case Study Presentation**

249 The Rhône is one of the main French rivers, rising in Switzerland and running towards southeastern
250 France, ending in the Mediterranean Sea by the Camargue delta. The river operation and governance
251 changed through history. After the Second World War, the semi-public company CNR (Rhône
252 National Company) was created by French State representatives and was given the concession for
253 managing the Rhône River, with the aim of developing three missions: hydropower production,
254 navigation, and developing irrigation. From 1935 to 1986, CNR built 19 hydropower stations (with
255 dams and dykes) along the river, between the Swiss border and the upstream part of the delta. CNR is
256 responsible for operating and managing the Rhône infrastructures within this territory. The
257 management of infrastructures within the delta is left to local authorities.

258 Four major floods occurred on the Rhône River in the 1990s and 2000s. Those floods sparked conflict
259 between inhabitants, the State, and the CNR. Inhabitants blamed the CNR works for exacerbating the

260 impact of floods through dyke and dam construction. They also believed that these developments were
261 indirectly responsible for agricultural dyke failures in the delta. After the floods in the 1990s, the State
262 asked the recently-created river association (Territoire Rhône) to carry out a study on flood risks and
263 propose risk reduction strategies. Results were released just before the 2003 floods. The State was then
264 accused of knowing that dykes were fragile, but not putting in place any kind of flood reduction
265 strategy. In 2003, several actors were entrusted with the problem of floods in the Rhône valley.
266 However, a lack of clear-cut responsibility created political crises.

267 As an answer to these issues, the State, along with other local representatives, created a governance
268 system (*Plan Rhône*) to manage flood risks and other issues at river level. *Plan Rhône* was initially
269 created to tackle floods, before being extended to cover other issues such as tourism, culture, energy,
270 water quality, and transport. This institution was designed in 2007 as a strategic and financial contract
271 signed between the State, Regional authorities, CNR, and the European Union (ERDF). This provided
272 175M€, 200 M€, 185M€ and 33 M€ of funding respectively. Beyond these main partners, *Plan Rhône*
273 brought together other actors, by means of a steering committee: Departments, and main municipal
274 authorities located along the Rhône. Through consultative committees, local inhabitants and
275 associations were also associated. *Plan Rhône* was a financial partnership allowed to grant funds to
276 local governments, project managers or inhabitants wishing to implement projects consistent with
277 *Plan Rhône* strategy. As such, *Plan Rhône* was operating a kind of “trusteeship” (Li, 2007) on local
278 actors. Table 1 summarizes the spatial scope and the responsibilities of actors and institutions in
279 relation to flood management on the Rhône valley.

280 **Table 1: Spatial scope and responsibilities of actors and institutions in relation to flood**
281 **management in the area covered by the *Plan Rhône***

282 Nb: All figures have been adjusted to the area covered by the 5 regions involved in *Plan Rhône*.

283 **4. Analysis**

284 **4.1 The “functional fit” of *Plan Rhône* according to its leaders**

285 State officials at regional level were responsible for mapping flood risks at river basin level and
286 steering *Plan Rhône* process. They considered that flood was the primary issue to address in the area¹.
287 The flood section of *Plan Rhône* accounted for half of all funding. The reading of *Plan Rhône* official
288 documents reveals that participants understood the problem of flood in the Rhône valley as a lack of

¹ « the 2003 flood event provoked the creation of Plan Rhône. In 2004, the prime Minister assigned the Rhône ‘préfet’ (State official) to create a global strategy to prevent floods on the Rhône River » (interview with a State official at River basin level, May 2010) ; « the flood issue was the historical problem, the rallying theme. [Plan Rhône] sought to provide an answer to flood issues. At this period, the unique theme to address was flood. » (interview with a State official at River basin level - October 2012).

289 flood retention capacity of rural areas. The Plan asserts an overall economic goal: “reducing flood
290 damages”. This was to be achieved by a twofold strategy: (1) raising and strengthening some dykes in
291 urban areas in order to avoid frequent flooding: “reducing flood discharges that are the most
292 damageable to densely populated areas”, (2) lowering dykes in rural areas in order to store water
293 during extreme floods: “enabling the riverbed to accommodate the rise in water levels”, “preserving
294 floodplain retention capacity”, “optimizing the flooding in some plains”.

295 One of the main target sites of the flood section was located in the Lower Rhône region, where major
296 floods had occurred. Entitled “Floodplains Optimization Program”, the strategy consisted of
297 modifying the distribution of risk by: i) enhancing the protection of plains experiencing frequent
298 flooding (on average once every ten years) ii) increasing water storage capacity by adding a spillway
299 onto a CNR dyke protecting a rural floodplain against 1000 year return period floods. This latter was
300 entitled “floodplain restoration project”. Besides this Floodplains Optimization Program, *Plan Rhône*
301 was supposed to finance dyke reinforcement around the Rhône delta. Figure 1 represents *Plan Rhône*
302 territory and identifies floodplains concerned by the Floodplains Optimization Program.

303 **Figure 2: Map of *Plan Rhône* territories: the Regions, the sub-basin areas and the floodplain**
304 **restoration program**

305 As flood experts, *Plan Rhône* leaders understood the issues in hydrological terms. Based on
306 hydrological knowledge, they calculated the dynamic pattern of a 100-year flood taken as a reference
307 of extreme flows. They estimated the amount of water that could safely flow between the consolidated
308 levees and dykes in urban areas. By deduction they determined the retention capacity that was to be
309 found for preventing levee failure. They screened the existing levees that could be lowered in rural
310 areas without threatening buildings and found that one levee owned by CNR for hydropower and
311 navigation purposes would be a good candidate for implementing a spillover. The floodplain to be
312 restored was on the territory of two rural municipalities Piolenc and Mornas. *Plan Rhône* became the
313 arena where actors could meet and cooperate to implement this project.

314 *Plan Rhône* leaders paid attention to the dynamic of urbanization. Floodplains earmarked for
315 restoration were ruled by a no-construction provision in a State-approved urban planning document.
316 They also identified that economic considerations would loom large as factors possibly affecting the
317 project. The cost of the spillover was to be covered by financial provisions of the contract. The
318 benefits downstream urban areas would get from the project could cover the farming losses upstream
319 rural areas may suffer, according what *Plan Rhône* leaders called “river-basin solidarity”. The
320 economic loss CNR may experience due to the spillover had to be negotiated within the concession
321 contract between CNR and the State. The overall contract included a clear-cut and deemed effective
322 compliance mechanism: EU funds were subjected to the effective implementation of floodplain
323 restoration project.

324 As expressed in interviews, State officials steering the *Plan Rhône* considered that this system of
325 governance corresponded to the definition of a “functional fit” for the following reasons:

326 - Its spatial scope was clearly defined and coincided with that of the flood issues (the watershed level),
327 including the floodplains.

328 - Actors involved in flood issues were also involved in the governance. State actors responsible for
329 mapping flood risks steered *Plan Rhône* process. Regions were included in *Plan Rhône* as strategic
330 and financial partners. Other floodplain stakeholders such as Departments, municipal authorities and
331 inhabitants participated to steering committees.

332 - *Plan Rhône* contributed to enhance the knowledge of other factors possibly affecting flood risks by
333 financing:

- 334 • Hydraulic studies in order to understand floodplain and dyke behaviors and the potential
335 hydraulic effects of the modification of the system;
- 336 • Economic studies in order to assess the economic efficiency of the hydraulic-sound strategies;
- 337 • Sociological studies in order to assess the perception of flood risk among riparian inhabitants.

338 - Some compliance mechanisms preexisted:

- 339 • The planning document defined at river level (SDAGE) imposed to offset the effects of any
340 dyke-raising project with hydraulic compensation (particularly through floodplain restoration);
- 341 • Municipal urban plans designed by municipalities and validated by the State limited
342 construction in floodplains.

343 - Others compliance mechanisms were settled under the stewardship of *Plan Rhône*:

- 344 • EU funding was granted under the condition of not being used for mere dyke-raising.

345 Between 2007 and 2012, State officials in charge of coordinating the flood section tried to persuade
346 local governments to take responsibility for the implementation of the Floodplains optimization
347 program through *Plan Rhône* funds. However, the floodplain restoration project proved to be very
348 controversial among Rhône stakeholders, particularly municipalities. It was finally abandoned in 2012,
349 spelling the end of the Floodplains Optimization Program. In the end, the main achievement of *Plan*
350 *Rhône* (2007-2013) was the enhancement of existing dykes and the construction of new ones, without
351 any real progress in terms of improving floodplain retention capacity. Using “functional fit”
352 arguments, *Plan Rhône* leaders attributed this failure to a number of factors:

353 - Detailed studies revealed uncertainties and constrains that were not identified when *Plan Rhône*
354 objectives were defined. The planning document *Plan Rhône* leaders relied on, did not mention
355 already built areas. Detailed floodplain topography at higher resolution revealed less retention capacity
356 than expected. Storing flows in the floodplain proved to be a possible threat on the high speed railway
357 infrastructure crossing the area. Such constraints raised the costs associated with *Plan Rhône*.

358 - Opposition to the project revealed that some stakeholders gained a *de facto* “veto power” that State
359 actors had ignored. The project entailed modifying a dyke owned by the CNR. State actors wrongly
360 believed they had the power to impose the change. CNR’s interests were vested in a concession
361 contract fostering hydropower, transportation and irrigation, not flood management. Beyond economic
362 considerations, CNR did not want to take responsibility in flood management. In addition, State
363 officials, acting as trustees rather than initiators, did not have the power to implement the project
364 themselves. Whereas in theory, local stakeholders had to comply with river-basin regulations, in
365 practice, they gained a “veto power” because they could refuse to initiate projects complying with the
366 aims of *Plan Rhône*. State officials did not manage to convince local stakeholders to take
367 responsibility for the project. The vested interest of local stakeholders (localized flood protection) can
368 explain this refusal.

369 - Compliance mechanisms were not restrictive enough to oblige stakeholders to implement the project.
370 No whistle-blower voiced the lack of compliance to the SDAGE or the lack of compliance to EU
371 funding rules to national or European courts. Dykes were raised without restoring the floodplain as
372 compensation.

373 The “functional fit” approach allows us to identify the *a posteriori* weaknesses of *Plan Rhône*
374 implementation, despite the *a priori* consistency of its rules. In the institutional design of *Plan Rhône*,
375 stakeholders considered the issue of consistent rules and financial compliance mechanisms. However,
376 the responsibility to initiate projects (such as constructing a spillover or dismantling a levee) was not
377 given sufficient attention. In this case, the absence of a defined project leader at the design stage of
378 *Plan Rhône* partly explains the project failure. This phenomenon of inconsistency between the
379 objectives of a program and the project leaders for its implementation echoes the lack of « institutional
380 congruence » as defined by Junier *et al.* (2011). State actors who steered the process underestimated
381 uncertainties, vested interests and veto-players in the first place.

382 Paradoxically State officials remained legitimate spokespersons of *Plan Rhône*. However,
383 municipalities and inhabitants called for a rescaling of the problem at State level. Inhabitants of flood
384 prone areas claimed recognition of their status by the State. They raised the issue in Parliament, but in
385 vain. *Plan Rhône* leaders argued in favor of this legal status for flood prone landowners with no more
386 success. Then, they asked the government to modify a law to be able to initiate the floodplain
387 restoration project in the name of the State. This solution of last resort failed too. This raises the
388 question of State level legitimacy for local actors. The political weight of the State must be analyzed
389 through the use of “politics of scale” literature.

390 **4.2 *Plan Rhône* and the “politics of scale”**

391 Unlike *Plan Rhône* leaders, other actors in *Plan Rhône* did not perceive the flood issues in terms of
392 retention capacity. According to their vested interests and leeway for action they rescaled the issue

393 during the process. Their definition of the problem drew different system boundaries and another level
394 of legitimate governance, that of the State. The legitimacy of the State results from a long story of
395 State intervention on the Rhône River. Despite their willingness to implement a decentralized
396 governance at river-basin level, State officials are imbued with beliefs inherited from State-level
397 institutions.

398 *4.2.1 Rescaling flood issue at the national scale*

399 In opposition to the strategy built by State officials, other actors defined the problem of floods at
400 another scale, competing with *Plan Rhône* boundaries. Instead, municipalities, CNR and local
401 authorities attempted to define flood issue at the scale of the nation.

402 *Municipalities rescaling of flood issue*

403 For municipalities, the problem of floods should be dealt with at the national scale for two reasons.

404 First, areas defined as *flood prone* and subjected to construction limitations are negotiated between
405 municipalities and the State. The State allows financial support to municipalities depending on the size
406 of their population. Therefore, municipalities that managed to develop before the implementation of
407 flood prevention plans, and were then allowed to reinforce their dykes, had advantages over others.
408 Municipalities located behind dykes have interest to define the problem at a national scale.

409 The second reason for this statement is that in France, the authorities are logistically and financially
410 best equipped to deal with flooding at national level. This is based on solidarity: i.e. the whole country
411 should bear the cost of repairing flood damage. A solidarity scheme (called CatNat), financed through
412 taxes on insurance premiums (Barraqué, 2014), is managed at the national level, and covers repair
413 costs in case of ‘natural disasters’, in order to avoid insurance companies being bankrupted by a
414 sudden influx of high-value claims. The government has the final say on which floods are recognized
415 as ‘national disasters’, and aims to encourage municipalities to limit their urban development in flood-
416 prone areas. Municipalities therefore argue for a national frame-scale of the problem.

417 Municipalities did not wish to implement the Floodplains Optimization Program defined by *Plan*
418 *Rhône* officials, and instead demanded that the national government recognize a legal status for
419 inhabitants living in floodplains¹. Municipalities found it difficult to identify any positive impacts of
420 the project designed by *Plan Rhône* officials on their inhabitants' welfare. The preexisting CatNat
421 system seemed less uncertain. This echoes the article of Erdlenbruch et al. (2009), which highlights
422 the difficulties in organizing local financial compensation schemes in case of floods because of the
423 high risk of local water management institutions going bankrupt in case of major floods . Instead of

¹ Two Laws were proposed by deputies to the government, in vain (Law proposals were N° 2739 (2005) and Law proposal N° 2596 (2010): “aiming at granting a particular status to municipalities and inhabitants living in floodplains”

424 modifying the local share of risk, municipalities referred to the national scale in order to demand a
425 public treatment of flood-management strategy by protecting all floodplains.

426 *CNR rescaling of flood issue*

427 The main reason for CNR to define flood issue at the national level was its reluctance to take
428 responsibility for this problem. In particular, they refused to take in charge the implementation of the
429 Floodplains optimization project. CNR was fearing to be held responsible for the damages in case of
430 floods. A legal study realized by State officials revealed the “strong reluctance” of CNR to undertake
431 the works planned by the Floodplains optimization project. Moreover, a letter from CNR legal services
432 addressed to State officials recalls that “the objective of the floodplain restoration project is out of the
433 scope of CNR’s responsibilities” and that “there is no mission neither objective within the concession
434 contract giving responsibility to CNR to manage Rhône floods”¹.

435 CNR claimed that their company was governed by national rules that prevailed over the local issue of
436 flood management. This argument is integral to a “politics of scale”. which favors energy production
437 at the expense of flood security, arguing that one is for the benefit of the whole country, whereas the
438 other is deemed more local. CNR began to focus more on what national law defined as its
439 responsibility, i.e. energy, navigation and irrigation. They denied any impact of the company's works
440 on flood patterns. CNR claimed to fulfil its responsibilities with regards to energy and boat traffic at
441 national level. Given the growing level of uncertainty regarding flood damage caused by spillway
442 implementation, the company officials decided that there was no advantage to deal with floods,
443 because of the resulting legal liability and high costs that would be incurred should they be
444 unsuccessful.

445 The rescaling of Rhône flood issues at the national level by municipalities and CNR illustrates their
446 interests to define a problem at a particular scale, but also beliefs inherited from Rhône development
447 history.

448 *4.2.2 Beliefs inherited from State level institutions*

449 State legitimacy for governing flood issues and the Rhône River development has gradually grown in
450 the public mind, given the long history of State intervention in building levees and controlling the
451 river. The strength of this *heritage* is illustrated in the action of State officials. In spite of their attempt
452 to define flood issue at *Plan Rhône* level, they reproduced the national framing.

453 *The Rhône River development, a national history*

454 Until the 19th Century, Rhône River floods were dealt with at community level (Bethemont, 1972;
455 Champion, 2000). Instances of flooding were opportunities for the Imperial government to exercise its

¹ Larrouy-Castera, DREAL Rhône-Alpes, 2011, “Mission d’assistance juridique sur les conditions de mise en œuvre du schéma de gestion des inondations du Rhône en aval de Viviers dans le cadre du Plan Rhône”.

456 legitimacy by granting occasional donations or advantages (Favier, 2007). The major flood events in
457 1840 and 1856 represented “critical junctures” used by the emerging centralized and modern State to
458 legitimate its domination. The “compassionate journey” of Napoleon III along the Rhône after the
459 1856 event illustrated the attempt by the State to construct its legitimacy following this event (Picon et
460 al., 2006). The Emperor came to see the victims and to observe the damage. Through this visit and
461 State support, the Rhone and its victims gained national interest, and the State, personified by
462 Napoleon, was sending a message of national involvement in recovery from loss. This symbolic
463 journey was the starting point of a flood protection public policy¹, based on dyke construction around
464 cities, drawing on the expertise of State-employed engineers² and public financial support. Large-scale
465 flood prevention infrastructure was built between 1860 and 1880. After the works in 1856, 30 000 ha
466 of land were protected from ordinary flood events (Bethemont, 1972, p.136). The risk of flooding
467 became a public issue to be dealt with at a national level. Rescaling the issue at the national level gave
468 legitimacy to the State by providing protection for citizens. The scale (from local to national), the
469 funding (from local to State-financial participation) and the actors³ involved in flood protection
470 changed. This mindset remained in place until the 1990s. Thanks to a long period without flooding,
471 this governance system remained unchallenged until major floods in the 20th Century.

472 The Rhône was the theater of a second “critical juncture” in State legitimization in 1945. After the
473 Second World War, the government undertook major modernization works, in particular on the
474 Rhône. The government set up a public company, CNR, with the aim of exploiting hydropower and
475 navigation from upstream of Lyon down to the delta. Large-scale modern dykes replaced or
476 supplemented infrastructures built in the 19th Century, in order to create hydroelectric dams. From the
477 1980s on, the government allowed another public company (EDF) to install four nuclear power
478 stations along the river, taking advantage of the cooling potential of the Rhone and of the existing
479 dykes. These works reinforced the dominant position of national-level river management (Hecht,
480 1998; Pritchard, 2004). The initial shareholder composition of CNR testified to the nationalization of
481 the River Rhone: Paris city and its region possessed 25%; the public railway company 25%; the Rhone
482 local governments 25%; and the remaining 25% went to industrial shareholders, including EDF
483 (Giandou, 1999). The State required EDF’s and CNR’s to avoid modifying Rhône flood regime.
484 However, compliance with this rule was hard to monitor, given the complex relationship between dyke

¹ The “public policy” concept refers to interventions by a public authority benefiting from governmental legitimacy over a particular domain of society or a territory, e.g. a regional public policy for disabled people; a national public policy for housing, etc. (Boussaguet, L., Jacquot, S., Revinet, P. (Eds.), 2006. Dictionnaire des politiques publiques, Paris.)

²The “Ponts et Chaussées” public body of engineers was created during the previous century (in 1716) under the Absolutist Monarchy. However, its importance regarding flood prevention on the Rhône increased after the major floods in 1840 and 1856.

³ In addition to the “Ponts et Chaussées” (Bridges and Roads), after the 1840 floods, a special administrative body was created to deal with Rhone issues: the Rhone Special Service.

485 raising and land use changes. Hydropower works, through dyke construction, transformed landscapes
486 and floodplains. However, CNR was not entitled to protect citizens from floods.

487 Between 1950 and 1993, no major floods occurred on the Rhône River. These 40 years of peaceful
488 climate, along with major public works (EDF and CNR) and discourse about security, as well as the
489 belief in technological progress, culminated in the removal of flood risk from the political agenda. No
490 “critical juncture” occurred to change the organization of flood governance on the Rhône, until the
491 1990s. In the meantime, the Rhone valley had undergone development behind CNR dykes.

492 The national history of the Rhône favored the scaling of flood issues at the national level. In spite of
493 their attempt to implement a flood management policy at the level of the River through a new
494 institution and a new boundary, State officials have reproduced the conditions favoring the national
495 framing of the issue.

496 *Plan Rhône promoters in between competing scales*

497 State officials operating at the Rhône basin level took charge of developing a flood management
498 strategy at the river level. However, in their attempt of restoring a floodplain, their project suffered
499 from uncertainties that participated to its failure. However, those uncertainties can be seen as *blind*
500 *spots* created by their framing of the flood issue at the national level.

501 First, State officials have long ignored the detailed topography of the floodplain supposed to be
502 restored. Mayors of this area demanded a detailed survey of the potential impact of flooding their
503 territory, This study¹ revealed that houses and firms (i.e 900 inhabitants) would be impacted adversely
504 by floods. Moreover, it revealed that the topography of the plain was less prone to store water than
505 planned. Second, State officials ignored that the high-speed railway, installed in the floodplain, would
506 hamper the development of the project. A study² realized by State officials revealed that its structure
507 would not support the strength of the water stored in the floodplain in case of floods. Last, State
508 officials overestimated their capacity to influence the State at central level to enable the project
509 implementation. The creation of a new law was needed to allow them to implement the project by
510 themselves, or to oblige CNR to implement it. However, the central government did not follow onto
511 this legal pathway. This belief came from their position as public actors, supposedly enabled to
512 negotiate local stakes at the national level. However, they overestimated their power to act on national-
513 level decision making.

¹ BLR Ingénierie, 2008, « Etude approfondie des conditions d’inondation de la plaine Mornas-Piolenc-Orange et notamment des conditions de remise en eau de cette plaine par le Rhône. Phase 1 et 2 : Approche hydrologique et analyse des enjeux »,

² DREAL Rhône-Alpes, 2011, « Compléments techniques à l’étude de faisabilité de remise en eau de la plaine de Piolenc-Mornas-Orange. Problématique liée à la présence de la ligne LGV », étude réalisée par ISL Ingénierie, Décembre 2011.

514 Consistent with ideas put forward in functionalist literature, uncertainties regarding the floodplain
515 restoration project negatively impacted its implementation. But such uncertainties were only revealed
516 afterwards. Similarly the veto power of municipalities did not appear at first to the actors of *Plan*
517 *Rhône*, but happened *a posteriori* in implementation. Finally, compliance mechanisms, which first
518 appeared as strict constraints, were circumvented more easily than anticipated. This analysis helps
519 understanding the weaknesses of a governance system but it does so *a posteriori*. This analysis only
520 provides us with limited advice since information about scientific uncertainties and compliance
521 mechanism failure was not accessible before implementation and was instead a product of the
522 implementation process.

523 What we characterized as *uncertainties* in the “functional fit” framework appears as *blind spots*
524 through a “politics of scale” analysis. Indeed, those uncertainties were created by the focus of State
525 officials on higher scales than the local one. Referring to the national scale created their ignorance of
526 the stakes located on the floodplain, and their overestimation of their influence on public (State level)
527 infrastructure and legislative production. This framing, through the production of *blind spots*, created
528 the conditions for the failure of the project.

529 The analysis of *Plan Rhône*’s failure through “politics of scale” revealed other implementation
530 constraints, linked to competing definition of the problem. In the implementation process, actors
531 revised their understanding of the problem through their interests and their beliefs. These were the
532 product of the river development history, built at a national level. These beliefs, shared by State
533 officials, were the cause of “blind-spots” that caused major uncertainties and misunderstandings of the
534 local situation, provoking the project failure.

535 **5. Conclusion**

536 Floods are typical physical issues that go beyond existing administrative frontiers. Experts advocate
537 managing floods at the river basin scale through the creation of dedicated institutions in order to fit the
538 governance system with the ecological system. Such an institution was created on the Rhone to tackle
539 flood issues. *Plan Rhône* stakeholders launched a new strategy of flood management that consisted of
540 restoring one rural floodplain. However, this floodplain restoration strategy failed. Some reasons for
541 this failure can be highlighted thanks to “functional fit” literature. However, these reasons do not
542 exhaust the case study analysis. In contrast, analysis through “politics of scale” literature revealed
543 other reasons for failure, linked to competing scales over flood management.

544 This analysis reveals that scales are historical products built through “critical junctures” and attempts
545 by institutions to build their legitimacy. It explains why actors do not naturally collaborate, even when
546 associated within a “fitting” institution. Actors and institutions can have conflicting views depending
547 on how they frame their respective interests, and the way in which they see problems. Conflicting
548 interests and representations can be highlighted through historical analysis focused on scale issues.

549 Confronting two different bodies of literature over a single case study draws us to several statements
550 and recommendations:

551 - The idea of fitting an institution to a particular problem implies that the representation of a problem
552 is uniformly perceived among actors. Scientific uncertainty around flood issues increases the
553 conflicting representations relating to the phenomenon, and therefore generates conflicting views as to
554 how it should be managed.

555 - The functionalist approach of fit and misfit involves in itself a particular representation of the
556 problem and of the institution legitimate to take it in charge. However, the definition of the scale of a
557 problem, and the institution legitimate to take it in charge, are submitted to conflicting representations,
558 that can hamper development of particular problem-solving strategies.

559 - The legitimization of a particular scale depends on history, interests, and representations. Scales are
560 historical products, and as such can hardly be modified by the willingness of some project holders.

561 -. Scales are political constructs rather than physical realities. Processes to change the level of an issue
562 require the support of the actors concerned, but can simultaneously trigger conflicting claims.
563 Defining the appropriate level to tackle an issue is the product of negotiations between political
564 interests, but once a level is institutionalized, it constrains the actors to manage the risk at this
565 particular level (Lebel, 2005).

566 - Addressing socio-ecological phenomena through institutional creation or modification should
567 overcome the functionalist definition of a scale. Long-term and political analysis can contribute to
568 increased knowledge about conflicting representations and interests over scales. So-called “wicked
569 issues” may be better addressed when actors and institutions are aware of the diversity of
570 representations regarding scales. Presenting a scale as ecologically sound is not sufficient to resolve
571 “wicked issues”. Rather, social and political drivers should be given more attention before considering
572 solving a problem at a particular scale.

573

574 Bibliography

- 575 Barraqué, B., 2014. The common property issue in flood control through land use in France. *Journal of*
576 *Flood Risk Management*.
- 577 Bethemont, J., 1972. Le thème de l'eau dans la vallée du Rhône. Essai sur la genèse d'un espace
578 hydraulique. Université de Saint Etienne.
- 579 Biswas, A.K., 2004. Integrated water resources management: a reassessment. *Water International*
580 29(1): 398-405.
- 581 Boussaguet, L., Jacquot, S., Revinet, P. (Eds.), 2006. Dictionnaire des politiques publiques, Paris.
- 582 Brenner, N., 2001. The limits to scale? Methodological reflections on scalar structuration *Progress in*
583 *Human Geography*, 25(4): 591-614.
- 584 Buizer, M., Arts, B., Kok, K., 2011. Governance, Scale and the Environment: The Importance of
585 Recognizing Knowledge Claims in Transdisciplinary Arenas. *Ecology and Society*, 16(1).
- 586 Cash, D.W. et al., 2006. Scale and Cross-Scale Dynamics: Governance and Information in a
587 Multilevel World. *Ecology and Society*, 11(2).
- 588 Cash, D.W. et al., 2003. Knowledge systems for sustainable development. *Proceedings of the National*
589 *Academy of Sciences of the United States of America*(100): 8086-8091.
- 590 Champion, M., 2000. Les inondations en France du VI^{ème} siècle à nos jours. , vol. III. Cemagref
591 Editions.
- 592 Ekstrom, J.A., Young, O.R., 2009. Evaluating Functional Fit between a Set of Institutions and an
593 Ecosystem. *Ecology and Society*, 14(2).
- 594 Erdlenbruch, K., Thoyer, S., Grelot, F., Kast, R., Enjolras, G., 2009. Risk-sharing policies in the
595 context of the French Flood Prevention Action Programmes. *Journal of Environmental*
596 *Management*, 91(2009): 363-369.
- 597 Favier, R., 2007. L'histoire sociale des catastrophes naturelles en questions Sources et problématiques
598 nouvelles. In: Favier, R., Remacle, C. (Eds.), *Gestion sociale des risques naturels*, pp. 155-
599 172.
- 600 Folke, C., Pritchard, J.L., Berkes, F., Colding, J., Svedin, U., 2007. The Problem of Fit between
601 Ecosystems and Institutions: Ten Years Later. *Ecology and Society*, 12(1).
- 602 Forsyth, T., 2003. *Critical Political Ecology: The Politics of Environmental Science*. Routledge,
603 London, 320 pp.
- 604 Gerber, J.-D., Knoepfel, P., Nahrath, S., Varone, F., 2009. Institutional Resource Regimes: Towards
605 sustainability through the combination of property-rights theory and policy analysis.
606 *Ecological Economics*, 68(3): 798-809.
- 607 Giandou, A., 1999. La compagnie nationale du Rhône (1933-1988). Histoire d'un partenaire Régional
608 de l'Etat.
- 609 Gregory, C.E., Brierley, G., Le Heron, R., 2011. Governance Spaces for Sustainable River
610 Management. *Geography Compass*, 5(4): 182-199.
- 611 Hecht, G., 1998. *The radiance of France : nuclear power and national identity after World War II*. MIT
612 Press, Cambridge, MA.
- 613 Jessop, B., Brenner, N., Jones, M., 2008. Theorizing sociospatial relations. *Environment and Planning*
614 *D: Society and Space*, 26(3): 389-401.
- 615 Junier, S., Borowski, I., Bouleau, G., Interwies, E., Mostert, E., 2011. Implementing the Water
616 Framework Directive: lessons for the second planning cycle. In: Quevauviller, P., Borchers,
617 U., Thompson, K.C., Simonart, T. (Eds.), *The Water Framework Directive: Action*
618 *Programmes and Adaptation To Climate Change*. RSC Publishing, Cambridge.
- 619 Kurtz, H.E., 2003. Scale frames and counter-scale frames: constructing the problem of environmental
620 injustice. *Political Geography*, 22(8): 887-916.
- 621 Lach, D., Rayner, S., Ingram, H., 2005. Taming the waters: strategies to domesticate the wicked
622 problems of water resource management. *International Journal of Water*, 3(1).
- 623 Lebel, L., P. Garden, and M. Imamura, 2005. The politics of scale, position, and place in the
624 governance of water resources in the Mekong region. . *Ecology and Society* 10(2).
- 625 Li, T.M., 2007. *The will to improve. Governmentality, Development, and the Practice of Politics*.
626 Duke University Press, Durham & London, 374 pp.

- 627 Maltby, E., 1991. Wetland management goals: wise use and conservation. *Landscape and Urban*
628 *Planning*, 20: 9-18.
- 629 Mitchell, B., 2005. Integrated water resource management, institutional arrangements, and land-use
630 planning. *Environment and Planning A*, 37(8): 1335-1352.
- 631 Molle, F., 2007. Scales and power in river basin management: the Chao Phraya River in Thailand. *The*
632 *Geographical Journal*, 173(4): 358-373.
- 633 Molle, F., Mamanpoush, A., 2012. Scale, governance and the management of river basins: A case
634 study from Central Iran. *Geoforum*, 43(2): 285-294.
- 635 Moore, A., 2008. Rethinking scale as a geographical category: from analysis to practice. *Progress in*
636 *Human Geography*, 32(2): 203-225.
- 637 Moss, T., 2004. The governance of land use in river basins: prospects for overcoming problems of
638 institutional interplay with the EU Water Framework Directive. *Land Use Policy*, 21(1): 85-
639 94.
- 640 Moss, T., 2012. Spatial Fit, from Panacea to Practice: Implementing the EU Water Framework
641 Directive. *Ecology and Society*, 17(3).
- 642 Moss, T., Medd, W., Guy, S., Marvin, S., 2009. Organising water: The hidden role of intermediary
643 work. *Water Alternatives* 2(1): 16-33.
- 644 Moss, T., Monstadt, J. (Eds.), 2008. Restoring Floodplains in Europe. Policy Contexts and Project
645 Experiences. IWA, London.
- 646 Norgaard, R.B., Kallis, G., Kiparsky, M., 2008. Collectively engaging complex socio-ecological
647 systems: re-envisioning science, governance, and the California Delta. *Environmental Science*
648 *and Policy*.
- 649 Ostrom, E., 1990. *Governing the commons: the evolution of institutions for collective action*.
650 Cambridge University Press, Cambridge, UK, 279 pp.
- 651 Ostrom, E., 2009. A general framework for analyzing sustainability of social-ecological systems.
652 *Science* (325): 419-422.
- 653 Pahl-Wostl, C. et al., 2008. The importance of social learning and culture for sustainable water
654 management. *Ecological Economics*, 64(3): 484-495.
- 655 Picon, B., Allard, P., Claeyss-Mekdade, C., Killian, S., 2006. Gestion du risque inondation et
656 changement social dans le delta du Rhône. Les catastrophes de 1856 et 1993-1994. Cemagref.
- 657 Pritchard, S.B., 2004. Reconstructing the Rhône: the Cultural Politics of Nature and Nation in
658 Contemporary France, 1945-1997. *French Historical Studies*, 27(4): 765-799.
- 659 Rangan, H., Kull, C.A., 2009. What makes ecology 'political'? rethinking 'scale' in political ecology.
660 *Progress in Human Geography*, 33(1): 28-45.
- 661 Rittel, H., Webber, M., 1973. Dilemmas in a general theory of planning. *Policy Sciences*, 4(2): 155-
662 169.
- 663 Rydin, Y., 2007. Re-examining the role of knowledge within planning theory. *Planning Theory* (6): 52-
664 68.
- 665 Sax, J.L., Thompson Jr, B.H., Leshy, J.D., Abrams, R.H., 2006. Legal control of water resources.
666 Cases and materials. Fourth Edition. American Casebook Series. Thomson West, St Paul, MN.
- 667 Scarwell, H.-J., Laganier, R., 2004. Risque d'inondation et aménagement durable du territoire.
668 Environnement et société. Presses Universitaires du Septentrion, Villeneuve d'Ascq.
- 669 Swyngedouw, E., 1997. Neither local nor global: "glocalisation" and the politics of scale. In: Cox,
670 K.R. (Ed.), *Spaces of globalization: Reasserting the power of the local*. Guilford Press, New
671 York, pp. 137-166.
- 672 Swyngedouw, E., 2004. Globalisation or 'glocalisation'? Networks, territories and rescaling.
673 *Cambridge Review of International Affairs*, 17(1): 25-48.
- 674 Tobin, G.A., 1995. The levee love affair : a stormy relationship? *JAWRA Journal of the American*
675 *Water Resources Association*, 31(3): 359-367.
- 676 van Tatenhove, J.P.M., Leroy, P., 2003. Environment and Participation in a Context of Political
677 Modernisation. *Environmental values*, 12(2): 155-174.
- 678 Varone, F., Nahrath, S., Aubin, D., Gerber, J.-D., 2013. Functional regulatory spaces. *Policy Sciences*
679 *Wallis, P.J., Ison, R.L., 2011. Appreciating Institutional Complexity in Water Governance Dynamics:*
680 *A Case from the Murray-Darling Basin, Australia. Water Resources Management*, 25(15):
681 4081-4097.

- 682 Warner, J., Van Buuren, A., Edelenbos, J. (Eds.), 2013. Making Space for the River. IWA London,
683 New-York, 201 pp.
- 684 Wesselink, A., Warner, J., Kok, M., 2012. You gain some funding, you lose some freedom: The
685 ironies of flood protection in Limburg (The Netherlands). *Environmental Science & Policy*.
- 686 Young, O., 2002. The institutional dimensions of environmental change. Fit, interplay, and scale. MIT
687 Press, Cambridge, Massachusetts, USA.
- 688 Young, O.R., 1989. The Politics of International Regime Formation: Managing Natural Resources and
689 the Environment. *International Organization*, 43(3): 349-375.
- 690 Young, O.R., 1994. International governance. Cornell University Press, Ithaca.
- 691
- 692