



# To dam or not to dam in an age of anthropocene: Insights from a genealogy of media discourses

Silvia Flaminio, Hervé Piégay, Yves-François Le Lay

## ► To cite this version:

Silvia Flaminio, Hervé Piégay, Yves-François Le Lay. To dam or not to dam in an age of anthropocene: Insights from a genealogy of media discourses. *Anthropocene*, 2021, 36, pp.100312. 10.1016/j.ancene.2021.100312 . halshs-03420649

**HAL Id: halshs-03420649**

**<https://shs.hal.science/halshs-03420649>**

Submitted on 5 Jan 2024

**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.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

## **Title:**

To dam or not to dam? A genealogy of media discourses to highlight human-river relationships in the Anthropocene

## **Authors' names and addresses:**

Silvia Flaminio<sup>1,2</sup>, Hervé Piégay<sup>1</sup>, Yves-François Le Lay<sup>1</sup>

|                                                               |   |     |      |           |
|---------------------------------------------------------------|---|-----|------|-----------|
| 1 Université de Lyon, Laboratoire Environnement Ville Société |   |     |      |           |
| ENS de Lyon                                                   | - | UMR | 5600 | EVS       |
| Site                                                          |   |     |      | Descartes |
| 15 parvis René                                                |   |     |      | Descartes |
| BP 7000, 69342 Lyon Cedex 07 France                           |   |     |      |           |

2 Université de Lausanne, Institut de Géographie et durabilité  
Géopolis - CH-1015 Lausanne Suisse

## **Institution and address where the work was conducted:**

Université de Lyon, Laboratoire Environnement Ville Société  
ENS de Lyon - UMR 5600 EVS  
Site Descartes  
15 parvis René Descartes  
BP 7000, 69342 Lyon Cedex 07 France

## **Corresponding author:**

Silvia Flaminio [silvia.flaminio@unil.ch](mailto:silvia.flaminio@unil.ch)

+33 6 61 04 66 98

## **Author contributions:**

S.F. designed the study with input from H.P. and Y.F.L.L. S.F. built and analysed the corpus. S.F. wrote the article with contributions from H.P. and Y.F.L.L.

## **Declaration of interests:**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## **Acknowledgements**

The authors would like to thank their colleagues from the University of Lyon and from "Environnement Ville Société" for many interesting discussions on methods for analysing discourse. The authors would also like to thank the reviewers and the editor-in-chief for their insightful comments and suggestions. This work was performed within the framework of the EUR

H2O'Lyon (ANR-17-EURE-0018) of Université de Lyon, within the programme "Investissements d'Avenir" operated by the French National Research Agency (ANR).

## **Funding**

This study was supported by a PhD grant from the French Ministry of Research ("Contrat doctoral unique fléché normalien") from 2014 to 2017.

1   **Title**

2   To dam or not to dam in an age of anthropocene: Insights from a genealogy of media discourses

3   **Abstract**

4   Numerous studies have highlighted the negative consequences of dams (long-term alterations of  
5   Earth systems and social and economic injustices), and have questioned the sustainability of dams,  
6   i.e., the capacity of dams to meet the social, economic, and environmental needs of the current  
7   generation without compromising the needs of future generations. After having stalled in the 1990s,  
8   dam construction has entered a new period of growth. Recent research has shown that this new  
9   phase in dam building can be explained by the promotion of hydropower as clean energy. To clarify  
10   the continuing debate on the construction of dams, particularly on their impacts and sustainability  
11   into the future, this paper examines the discourses on dams within the public domain. We used a  
12   collection of newspaper articles published in *Le Monde* from 1945 to 2019 on dams that were  
13   planned and built throughout the world (n=1,471). Results show a rise of different discourses on  
14   water infrastructure, which with time deal less with positive technical appraisals and more with  
15   controversies. Since the mid-2000s, new arguments are defended (green energy) and new  
16   controversial discourses on the social and economic sustainability of dams (bearability, equitability)  
17   have emerged along with environmental questions (greenhouse gas footprint). These discourses  
18   reveal different understandings of sustainability which increase the complexity of the debate on  
19   dams. Results from this study suggest a need for a stronger dialogue between the scientific and  
20   public domains on the impacts of dams. Knowledge transfer and exchange would be particularly  
21   beneficial on ‘renewable energy’ and ‘green energy,’ and alternative modes of governance regarding  
22   dams.

23

24   **Keywords**

25

26   Dams

27   Discourse

28   Genealogical approach

29   Hydropower

30   Sustainability

31

32   **1. Introduction**

33   During the past century, numerous dams have been built throughout the world (Roe, 2012), with  
34   purposes that include irrigation, hydropower, water supply, flood prevention and navigation. These

35 hydraulic infrastructures interrupted the flow of water and created reservoirs upstream. Dam  
36 construction stalled during the 1990s, leading some to conclude that the era of big dams was over  
37 (e.g., Graf, 1999; McCully, 2001). This decline may be explainable by the reduction of attractive  
38 sites for dams, by changing water paradigms (Gleick, 2000) and by the progressive adoption by the  
39 water sector of the principles of sustainable development (Allan, 2003), whereby the needs of the  
40 current generation are met without compromising the needs of future generations (Brundtland,  
41 1987, p. 37).

42

43 Nevertheless, since the end of the 2000s, dam construction has entered a new period of growth.  
44 Plans for ‘mega-dams’ (Best, 2019) and for smaller dams (Fung et al., 2018) have multiplied,  
45 coupled with schemes for hydropower. Currently, 3,700 major hydropower dams are planned or  
46 under construction in the world (Zarfl et al., 2015). Even so, the amount of power produced, given  
47 the projected growth demand, is likely insufficient to replace non-renewable electricity resources  
48 (Zarfl et al., 2015, p. 167). Such a rebound in dam-building raises environmental questions that are  
49 both social and ecological. It feeds the scientific debate on long-term environmental degradation in  
50 the context of global environmental change, especially within an anthropocene era of accelerated  
51 human interactions with Earth systems (Chin et al., 2013). The consequences of constructing dams  
52 remain diverse (e.g., social, economic, ecological, and geomorphological), at different scales (local,  
53 corridor, regional, and even global) (Baghel, 2010; Gross, 2016; Skalak et al., 2013; Williams et al.,  
54 2014; World Commission on Dams, 2000). As numerous studies have demonstrated, dams have  
55 profoundly affected flow conditions, channel morphology and river ecosystems (e.g., Power et al.,  
56 1996; Poff et al., 1997; Rollet et al. 2014). They have even been described as an example of the  
57 “exploitation of Earth’s resources” which characterises the “Anthropocene” (Crutzen, 2002), and  
58 due to the drastic alteration of the world’s river systems they have caused, dams have been depicted  
59 as characteristic of the human domination of the Earth (Nüsser and Baghel, 2017). Recent research  
60 has shown that dams may not always be an advantageous option considering climate change. The  
61 reliance on reservoirs can worsen water and energy shortages (Di Baldassarre et al., 2018). Plans for  
62 hydropower dams in Eastern and Southern Africa, for example, will increase some countries’  
63 dependence on hydroelectricity and therefore their exposure to the “risk of climate-induced  
64 electricity disruption” (Conway et al., 2017, p. 949). Moreover, not only can the resurgence of dam  
65 building lead to the disappearance of the last free-flowing rivers (Grill et al., 2019; Nilsson, 2005),  
66 the impact of climate change will also be greater on impounded rivers than on free-flowing rivers,  
67 which are expected to be more resilient (Palmer et al., 2008). Furthermore, during the past years,  
68 restoration ecology and other environmental fields have promoted dam removal to prevent further

69 biodiversity loss and ‘reconnect’ watersheds (Magilligan et al., 2016). Among social scientists,  
70 debates regarding dam-building and the impact of dams are also strong, as they have shown how a  
71 new discourse on climate change and sustainability (Crow-Miller et al., 2017) is fuelling dam-  
72 building for hydropower or multipurpose reservoirs. Some states and institutions are framing  
73 hydroelectricity, for example, as renewable, ‘clean’, ‘green’ energy (Ahlers et al., 2015; Fletcher,  
74 2010; Warner et al., 2017). Altogether, scholars in different scientific fields are questioning the  
75 sustainability of dams (Di Baldassarre et al., 2021).

76

77 To clarify the continuing debate on the construction of dams, particularly on their impacts and  
78 sustainability into the future, this paper examines the discourses on dams within the public domain.  
79 We focus on the public due to the relevance of dams on people’s lives, such as in relation to water  
80 resource management and energy production, and since the public often exerts political power for  
81 decisions concerning dam-building. We also focus on the public discourses on dams since the mid-  
82 20<sup>th</sup> century, because this period includes the peak in dam building and the development of  
83 controversies regarding the negative impacts of dams (Roe, 2012). In this paper, we therefore  
84 address the following research questions. First, how have the discourses and debates on dams, and  
85 notably on the sustainability of dams, developed within the public domain? Second, how can tracing  
86 a ‘genealogy’ of discourses on dams inform their sustainability into the future?

87

## 88 **2. Approach, material and methods**

89

### 90 *2.1 General Approach*

91 This paper approaches the research questions with a Foucauldian perspective. Foucault promoted a  
92 ‘genealogical’ approach that examines “how series of discourse are formed [...]; what are their  
93 specific norms, and what are their conditions of emergence, growth and variation” and a critical  
94 approach that “distinguishes forms of exclusion, limitation and appropriation” (Foucault, 1971, p.  
95 62–63). Accordingly, we investigate not only the genealogy of discourses relating to dams, but also  
96 the controversies at work during different periods. This post-structuralist framework invites us to  
97 question and highlight the emergence and the development of new discourses regarding dams. It  
98 also helps to reveal how older discourses may still be present and are adaptable to current issues.  
99 We consider a discourse is made of oral or written statements (Adger et al., 2001). It is also “a  
100 shared way of apprehending the world. Embedded in language, it enables those who subscribe to it  
101 to interpret bits of information and tie them together into coherent stories or accounts” (Dryzek,

2012, p. 9). Following Foucault, previous studies on water and hydraulic infrastructure have illustrated the role and power of discourse, and notably its political ramifications (e.g., Duarte-Abadía et al., 2015; Boelens et al., 2016; Boelens et al., 2019).

In a nutshell, the relevance of studying discourses is twofold. On one hand, the study of discourses allows documentation of the relationship between society and dams, because discourses materialise this relationship in oral and written statements. On the other hand, since discourses have a performative value, studying discourses also allows better understanding of how planning choices regarding dams are made, and more generally how “political decision-making takes place” (Hajer, 1995: 44). While studies in natural sciences have increasingly highlighted the ecological impacts of dams since the 1960s (e.g., Scope, 1972), social sciences have often focused on controversies related to dam-building and their social consequences (e.g., Kaika, 2006; Hommes et al., 2016). Such research has focused on case studies situated in specific timeframes and socio-political contexts.

To consider more generally the public debate on dams and build a genealogy of discourses on dams, we used media as a primary source. Media capture the public domain well as places or forums in which individuals “engage each other about subjects of shared concern” (Pezzullo and Cox 2017, p. 20). Media and newspaper accounts also present many biases, as they personalise information, dramatise events, and tend toward novelty (Boykoff and Boykoff, 2007). Nevertheless, media play a role in political agenda setting (Downs, 2016) and reflect social concerns (de Loë, 1999). They are arenas among which new economic and environmental models can be produced (Burgess, 1990). Previous studies have highlighted the ‘centrality’ (Foxwell-Norton and Lester, 2017) of media in the communication of environmental issues and have recognised their value as a valid source to study environmental conflicts and as a stakeholder in environmental politics (e.g., Lester, 2010; Hansen, 2015). For these reasons, they can be valid for the study of environmental topics and controversies and their evolution over time. In other words, media allow study of the progression of “environmental issues in the public sphere” (Hansen, 2015, p. 217). In the social sciences and environmental studies, media sources have been successful to identify and distinguish different periods in water management on national scales (Wei et al., 2017, 2015).

In this study, we focus on both national and international news. This paper is based on media narratives from *Le Monde*, a French newspaper with a strong interest in international news and global socio-political debates (in a similar way to *The New York Times* or *The Guardian*). This source is particularly useful as *Le Monde* has digital archives dating back to the newspaper’s

134 foundation in 1944. Although previous studies have largely relied on content analysis (Wei et al.,  
135 2017), we implemented a method based on textual data analysis (also often called ‘text mining’).  
136 This study therefore details the evolution of discourses on dams (between 1945 and 2019). It  
137 situates in time the integration of social, economic, and ecological issues within the debate on dams.  
138 We then discuss results within the international scientific literature and debates on dams into the  
139 future.

140

## 141 2.2. *Material*

142

143 We targeted the newspaper *Le Monde* for the history of the debate on dams, tracing the genealogy  
144 of discourses on dams and the framing of dams as sustainable levers. Although a French newspaper  
145 may suggest a Franco-centred perspective, *Le Monde* pays much attention to international news and  
146 its reporting considers different and often diverging points of view. It is also one of the few major  
147 daily newspapers with archives available in formatted text. Notably, it is accessible through  
148 university library subscriptions (through its website, [www.lemonde.fr](http://www.lemonde.fr) or through online platforms  
149 such as [www.europresse.com](http://www.europresse.com)). *Le Monde*’s archives go back to the newspaper’s foundation in  
150 1944. Therefore, this source allows a longitudinal approach. Only a few other newspapers provide  
151 digitised archives over such a time span. For such reasons, *Le Monde* has been useful beyond  
152 francophone scholarship (Brossard et al., 2004).

153

## 154 2.3. *Data collection*

155 We combined different queries to avoid collecting articles that did not focus on hydraulic dams.  
156 The terms included “dam & river” (“*barrage & rivière*”, “*barrage & fleuve*”), “dam & lake”  
157 (“*barrage & lac*”), “dam & reservoir” (“*barrage & réservoir*”), “dam & licence” (“*barrage &*  
158 “*concession*”). These queries produced over 6,000 articles. Many duplicates were automatically  
159 excluded from the corpus. We then read and examined the articles individually. We excluded from  
160 the corpus articles that only briefly evoked dams. This process led to inclusion in the corpus of  
161 1,471 articles published between 1945 and 2019.

162

## 163 2.4. *Data preparation*

164 We collected and tabulated metadata on each article (publication date, author, article title). We also  
165 carried out a basic content analysis from the reading of the articles, focusing on information such as  
166 the dam site, the river or the river basin, and the country on which the article was centred. When the  
167 article only concerned one site, river, river basin or country, we also recorded this information in the

168 metadata table. Moreover, for each article, we determined if the newspaper mentioned a  
169 controversy, i.e., an opposition or a disagreement between different stakeholders or communities  
170 involving the dam. Finally, using the scale elaborated by de Lœe (1999), we determined whether the  
171 newspaper adopted a pro- or anti-dam tone, a neutral tone, and whether it presented both the pros  
172 and cons or simply whether the dam played a marginal role in the article.

173

## 174 2.5. Data analysis

175 To explore and analyse the data in the metadata table, we firstly summarised and plotted several key  
176 characteristics. The number of articles published per year, for example, identified periods of over  
177 and under news coverage. We also considered the evolution of dam building in the world between  
178 1945 and 2020, based on the *World Register of Dams* (ICOLD, 2018), which represents dam  
179 builders and managers, and the International Commission on Large Dams (ICOLD), and which  
180 contained information on the building date of 51,514 dams throughout the world. After culling the  
181 data for the building of dams per year, we also measured the ratio between the dam coverage by *Le*  
182 *Monde* between January 1945 and December 2019, according to our corpus, and the total number of  
183 articles published each year in the newspaper. We further identified the countries and dams that  
184 benefited from a broad coverage by *Le Monde*: we were able to attribute countries to 1,425 articles  
185 out of 1,471.

186

187 Secondly, we performed a quantitative textual data analysis with the open-source programs  
188 Iramuteq (Ratinaud and Déjean, 2009) and TXM (Heiden et al., 2010). Textual data analysis, also  
189 often called ‘text mining’, is definable as a set of methods that rest on statistics to analyse text  
190 corpora (Beaudouin, 2016; Heiden et al., 2010). Iramuteq relies on R software and Python language  
191 to perform analyses such as the classification algorithm (Reinert, 1990, 1983), which comprises five  
192 main phases (Cottet et al., 2015). The classification algorithm proceeds through several steps. First,  
193 it segments the corpus into phrases (of 40 words approximately). Second, it lemmatises<sup>1</sup> the words  
194 using a grammatical dictionary. Third, it produces a contingency table between the lemma and other  
195 forms such as the metadata and the text segments. Fourth, it builds a top-down hierarchical  
196 classification based on the contingency table (using  $\chi^2$  metrics). Fifth, it leads to the description of  
197 different lexical classes that present the degree of association between each class and the different

---

<sup>1</sup> In linguistics, a lemma is generally defined as “a set of lexical forms having the same stem and belonging to the same major word class, differing only in inflection and / or spelling” (Francis and Kucera, 1982: 1). In general, a lemma is the standard dictionary entry of a word. To lemmatise means to tag words of a corpus according to their stem. In this case, the software we use matches each word of the corpus to a dictionary entry.

198 forms (also using  $\chi^2$  metrics). Recent studies have used this method to identify discourses on  
199 different environmental subjects, such as invasive species (Cottet et al., 2015), rivers (Comby et al.,  
200 2019), and water conservation (Boyer et al., 2021). In this case, the classification algorithm allowed  
201 for the identification of 12 different lexical classes. We then considered the degree of association  
202 between the different classes and the decade of publication of the texts. We used the open-source  
203 data visualisation framework RAW Graphs (Mauri et al., 2017), and in particular the ‘area graph’,  
204 to represent the  $\chi^2$  for each class according to the different decades.

205

206 In parallel, we used the ‘progression’ function of TXM (which also relies on R statistical libraries)  
207 to examine the evolution of specific words and expressions within the corpus, according to the  
208 publication year of the newspaper articles. We produced graphs displaying the cumulative  
209 frequencies of different expressions such as “wild river” (“*rivière|fleuve sauvage*”) and “living  
210 river” (“*rivière|fleuve vivant*”) or “greenhouse gas” (“*gaz à effet de serre*”).

211

212 Thirdly, we conducted a qualitative and interpretative analysis. We read all 1,471 articles comprised  
213 in the corpus. Based on the reading of the corpus and keyword searches performed in TXM, we  
214 identified quotes reflecting evolutions that we had previously statistically observed.

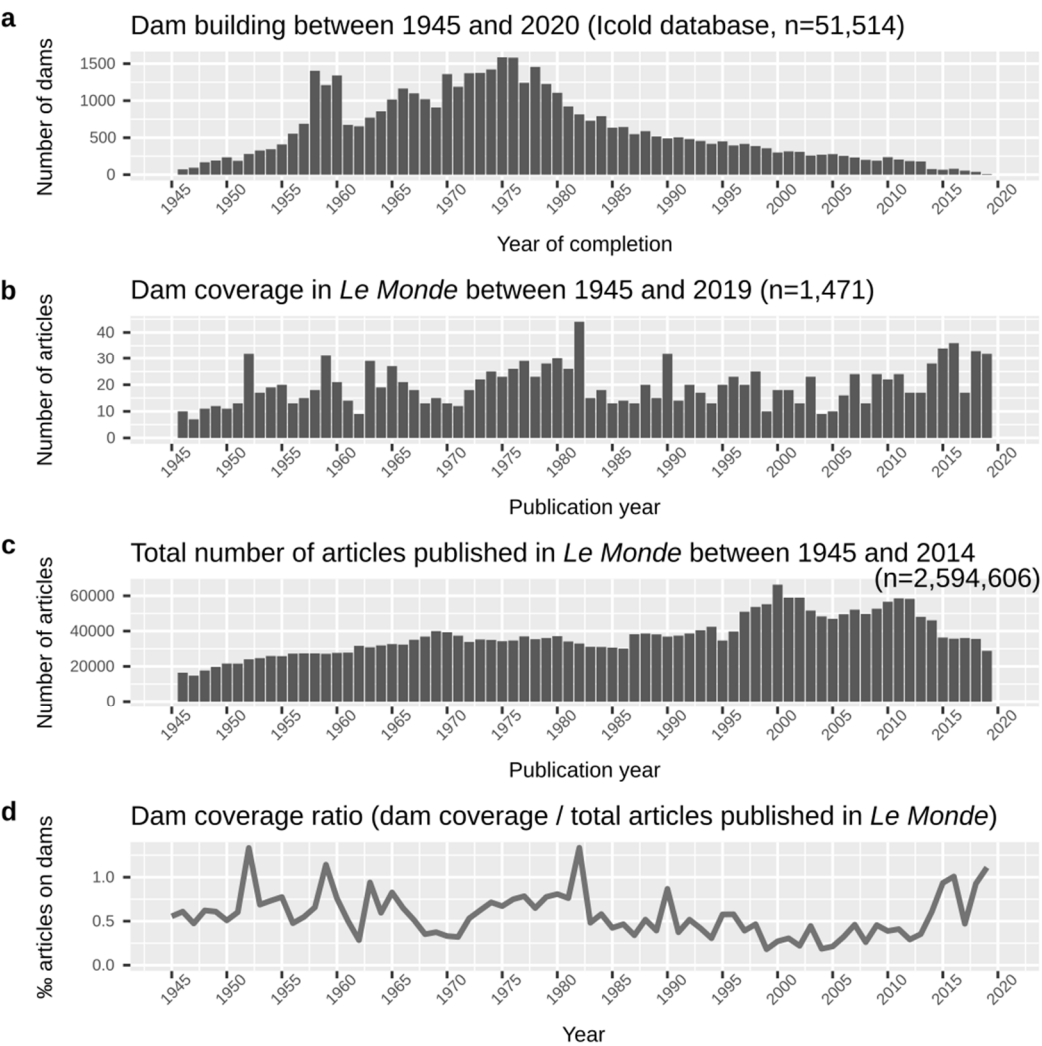
215

## 216 **3. Results**

### 217 **3.1 Characteristics of coverage by *Le Monde***

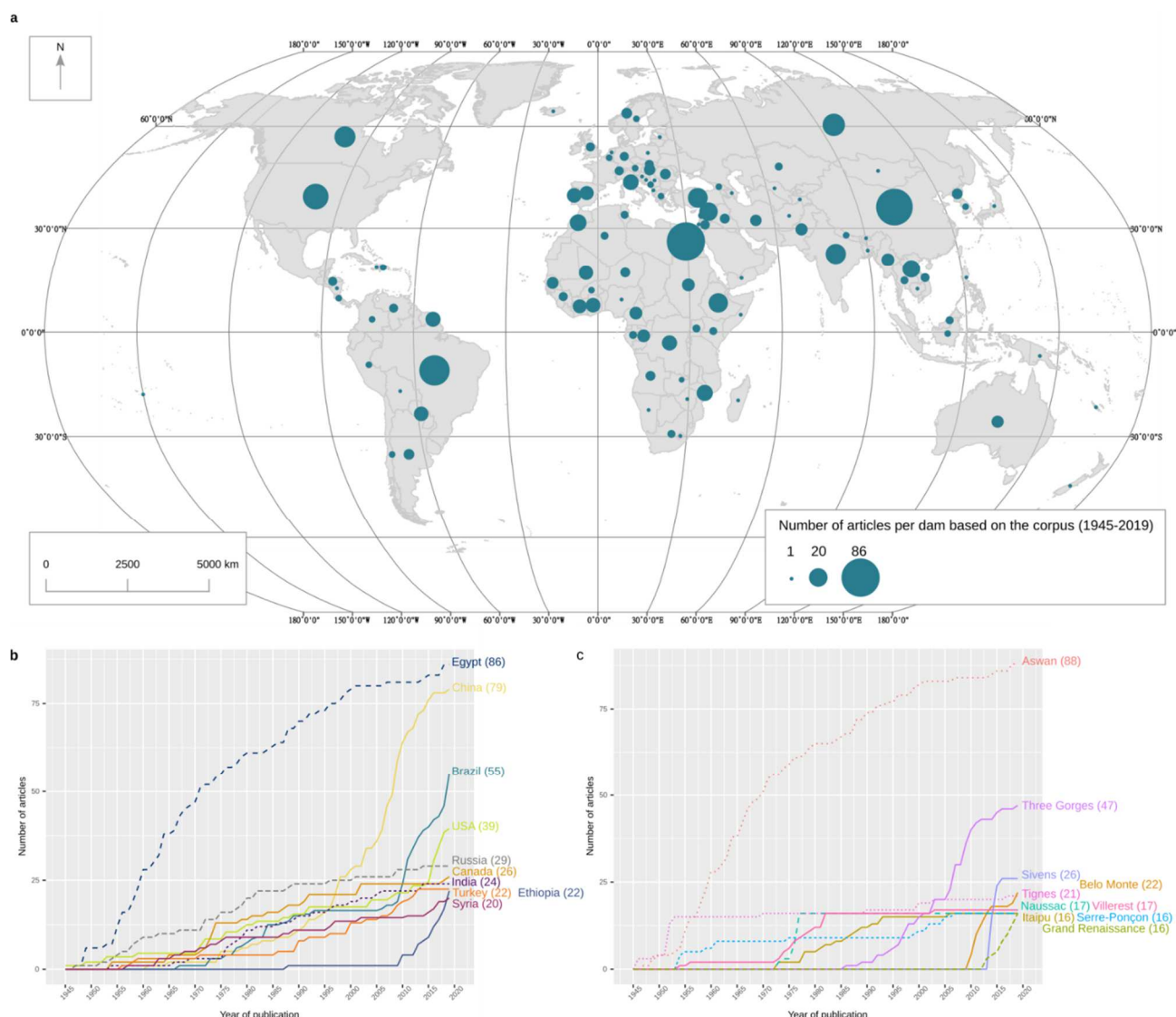
218 The coverage by *Le Monde* was mostly strong during the main period of dam building throughout  
219 the world, i.e., between the 1950s and the 1970s (Fig. 1). The coverage was characterised by  
220 various peaks (e.g., 1952, 1959, 1982, 1990). The qualitative analysis allowed us to link some of  
221 these peaks to specific dam projects and controversies: the building of Tignes Dam in France  
222 received much attention in 1952; in 1959, *Le Monde* published a series of articles on the Malpasset  
223 disaster (Southern France); other peaks such as the 1982 and 1990 ones did not coincide with a  
224 single project event or controversy. After 1980, and during a period in which less dams were being  
225 built, *Le Monde* paid less attention to dams (Fig. 1). However, after 2010, the coverage of dams  
226 increased again.

227



**Fig. 1.** Dam building in the world and dam coverage in *Le Monde* (1945-2019). a, Number of dams built between 1945 and 2020 according to the World Register of Dams database (n=51,514). b, Number of articles in the corpus on dams published between 1945 and 2019 in *Le Monde* (n=1,471). c, Total number of articles published in *Le Monde* between 1945 and 2019 (n=2,594,606). d, Ratio between the number of articles on dams published in year in *Le Monde*, and the total number of articles published per year by the newspaper (per mille).

*Le Monde*'s coverage was both international and Franco-centred. The corpus included 582 articles focused on France (40,1%). It also encompassed articles on 105 other countries (Fig. 2). Much attention was paid to dams planned or built in Egypt and China, and in particular to the Aswan High Dam (with some articles also focused on Sudan) and the Three Gorges Dam (Fig. 2).

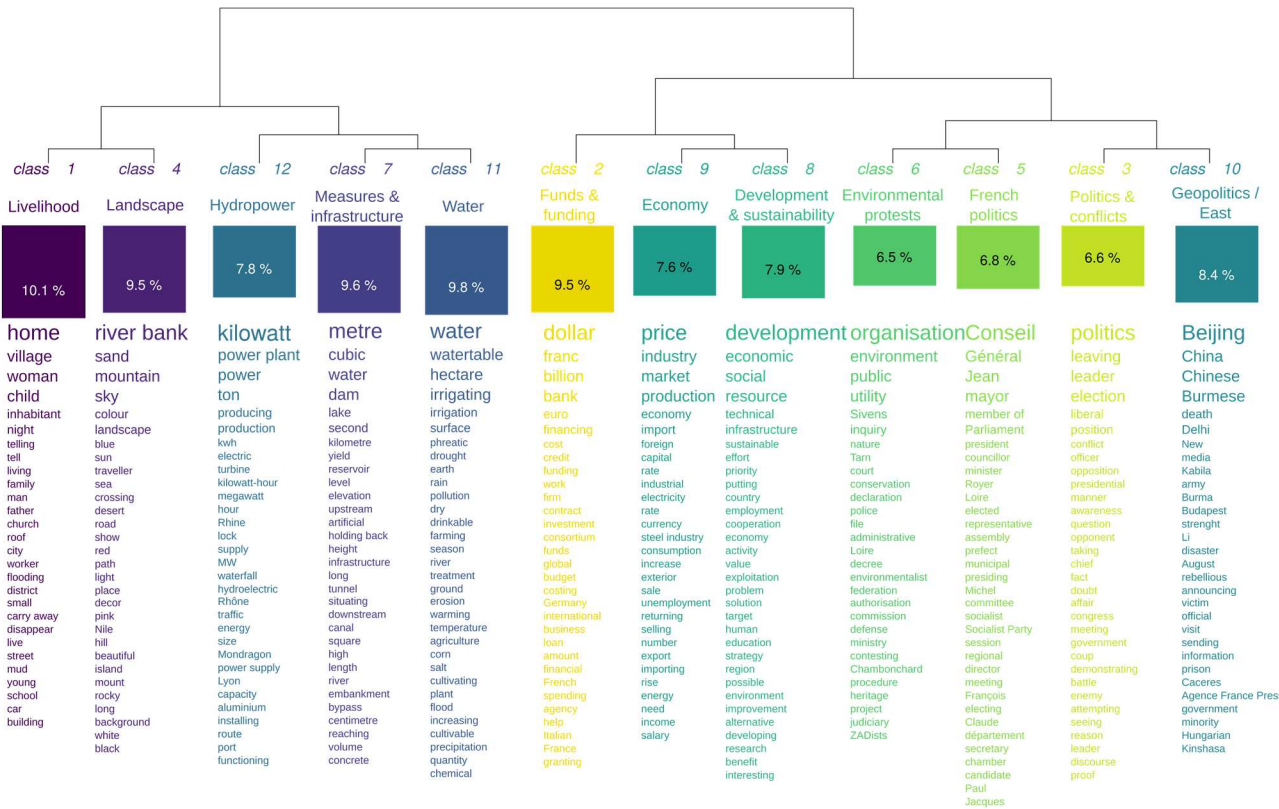


**Fig. 2. Spatial characteristics of *Le Monde*'s coverage of dams (1945-2019).** a, Articles on dams per country (excluding France). b, Cumulative frequency of the number of articles published on the ten main countries based on the corpus (excluding France). c, Cumulative frequency of the number of articles published on the ten main dams based on the corpus.

### 3.2. From economics to livelihoods: Twelve themes relating to dam-building (1945-2019)

Twelve major themes that relate to dams appeared in *Le Monde* (Fig. 3). Politics and geopolitics represented 1/5 of the newspaper articles' content (classes 3, 5 and 10). Journalists also lengthily described the landscape and the populations affected by dam-building (classes 1 and 4). Technical characteristics of the infrastructures, rivers and lakes, also often appeared (classes 7, 11 and 12). Industry and economy, as well as the funding issue, were also topical issues (classes 2 and 9). Whereas environmental protests represented one of the smallest classes of the corpus (class 6,

274 6.5%), development and sustainability played a relatively important role in the articles (circa 8%).  
 275 These themes related to discourses held on dams that have evolved through time.



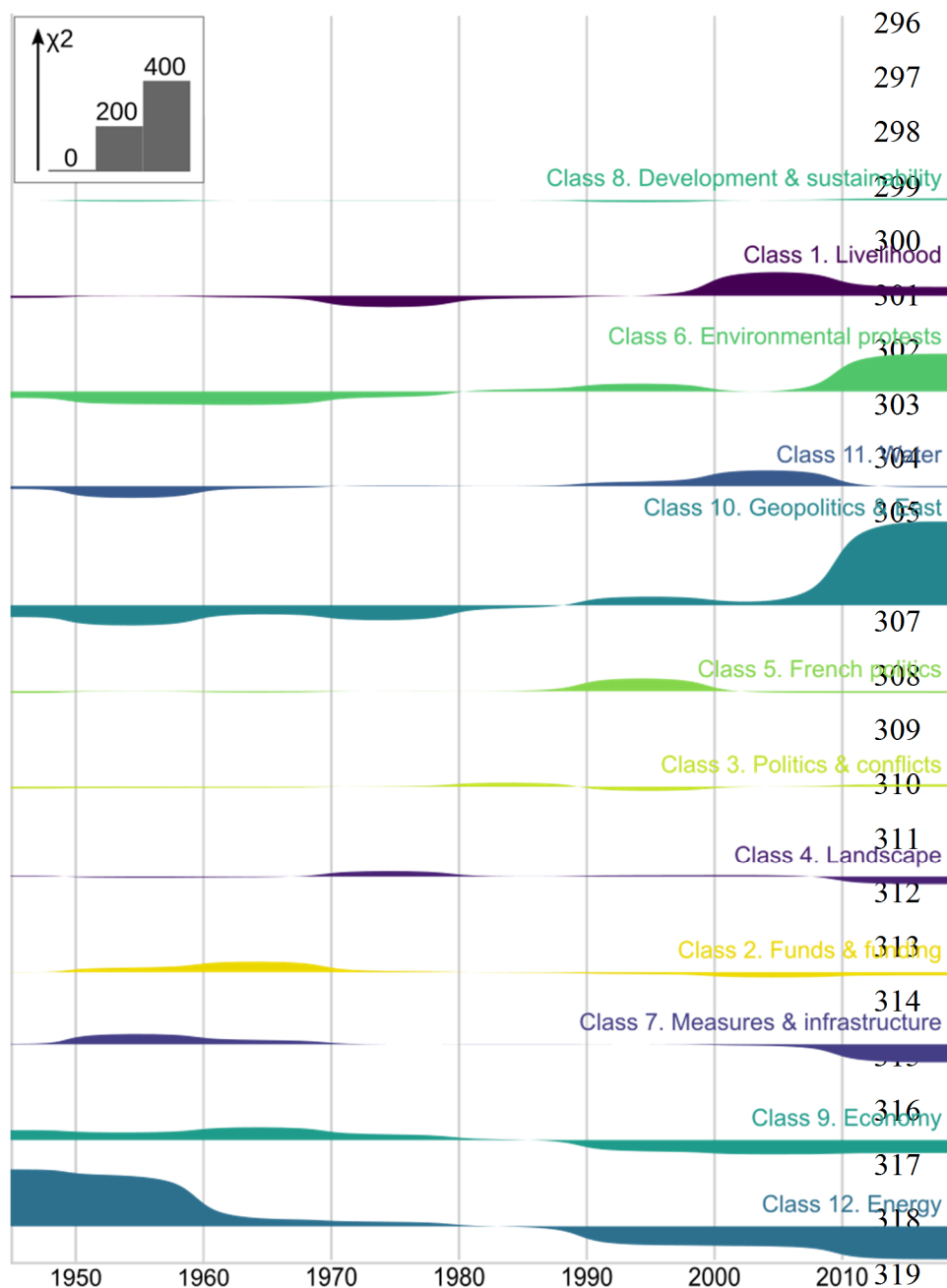
276 **Fig. 3.** The 12 lexical classes of *Le Monde's* articles on dams (1945-2019). The figure is the result  
 277 of the hierarchical classification of the textual segments performed with Iramuteq. The authors  
 278 added the keywords, established through a qualitative analysis, underneath the class numbers to  
 279 facilitate reading the figure.

280  
 281 **3.2. A discourse focused on the materiality of dams and on their economic and energy**  
 282 **performances (1945-1960s)**

283 From 1945 to the beginning of the 1970s, three lexical fields were over-represented in *Le Monde's*  
 284 articles on dams (Fig. 4). The journalists described in great detail technical aspects of dams,  
 285 attaching particular importance to the size of the infrastructures.

286  
 287 Energy consumption and production were also a major theme of the articles in the 1940s and 1950s.  
 288 This issue, coupled with economic questions along with industry, capital, finances, and  
 289 development, were also frequently evoked. The focus on energy and economics is explainable by  
 290 the fact that, during this period, whereas France was experiencing economic growth (the 'Trente  
 291 Glorieuses' period, in connection with the Marshall Plan), the newspaper mainly described dams

planned or under construction in France. The newspaper also focused on countries historically linked to France (colonies or ex-colonies, such as Morocco or the Ivory Coast), and dams financially supported by France or with involvement from French engineers (such as Aswan in Egypt, Fig. 2c, or Cahora Bassa in Mozambique).



**Fig. 4. Evolution of the 12 lexical classes between 1945 and 2019.** The figure, made with RAW Graphs, shows the degree of association ( $\chi^2$ ) between the different classes and the decade of publication of the newspaper articles. The degree of association can be positive or negative (above or below the horizontal lines). The scale representing the degree of association is shown in the top-left corner of the figure.

326

327 A qualitative analysis of the newspaper articles showed that, between 1945 and the end of the  
328 1960s, dams were described as solutions to different types of crises such as drought, flood, water  
329 supply or energy shortage. The articles presented dams as tools for development and modernisation,  
330 most often on a national scale. Although most newspaper articles remained neutral (i.e., they did  
331 not explicitly support the dam projects), some articles demonstrated pride towards the  
332 infrastructures and engineering technicity. Regarding the Roselend scheme in the French Alps, a  
333 journalist asserted France's superiority over the United States or the Soviet Union: "None of the  
334 foreigners [who were visiting the dam and its power plant, La Bâthie] claimed to have something  
335 better at home. Not even a Soviet. Not even an American" (*Le Monde*, 10<sup>th</sup> August 1961). Dams  
336 were tightly linked with a discourse on national interests and on political and economic  
337 independence in the post-World War II and Cold War contexts. Some articles highlighted the beauty  
338 of the dams by comparing them to temples or cathedrals. In the newspaper articles, water was  
339 represented as raw material that does not have a cost, as a resource that could be entirely exploited  
340 for human activities by implementing "rational" projects. The Dordogne River (in the southwest of  
341 France) was described as having been "rationally equipped" and as one of the "best examples of the  
342 complete usage of a river" (*Le Monde*, 1<sup>st</sup> July 1953). The newspaper articles rarely described the  
343 source of water and the environment in which water flows. Rather, journalists mentioned head and  
344 flow rate, "white coal" ("*houille blanche*") when they described water, or "liquid stairways" (*Le*  
345 *Monde*, 25<sup>th</sup> May 1964).

346

347 Nevertheless, some articles mentioned debates, disputes and controversies before the 1970s. Local  
348 negative consequences were evoked, notably those related to land loss (e.g., during the construction  
349 of the Tignes Dam in the Central French Alps), and regional oppositions between downstream and  
350 upstream interests (e.g., Serre-Ponçon Dam and the Durance valley in the French Southern Alps).  
351 Although some articles focused on the benefits of the Aswan High Dam (in Egypt), others  
352 underlined the geopolitical tensions linked to the project and the archaeological consequences of the  
353 inundation of Nubia even after the reconstruction of the Abu Simbel temple. The international  
354 campaign related to the dam, carefully followed and reported on by *Le Monde*, influenced French  
355 journalists to adopt a more critical perspective regarding the benefits of dams. By the end of the  
356 1960s, a shift had taken place: while economics, energy production and the technical characteristics  
357 of dams played an increasingly smaller role in the discourses on dams, the articles began to question  
358 the assets of dams.

359

### 360 3.3. A discourse increasingly adding value to the socio-natural environment and landscape 361 (1970s-1980s)

362 During the 1970s and the 1980s, as dam building reached its peak, dams were extremely topical  
363 (Fig. 1b and 1d). Nevertheless, these two decades did not present major specificities from a  
364 discursive point of view (Fig. 3). Although some themes grew during the 1970s—such as landscape  
365 (Fig. 3, class 4)—and the 1980s—such as politics and conflicts (class 3) or environmental protests  
366 (class 6)—they did not dominate the articles as much as energy or the technical aspects of dam  
367 building that dominated the articles in the 1950s.

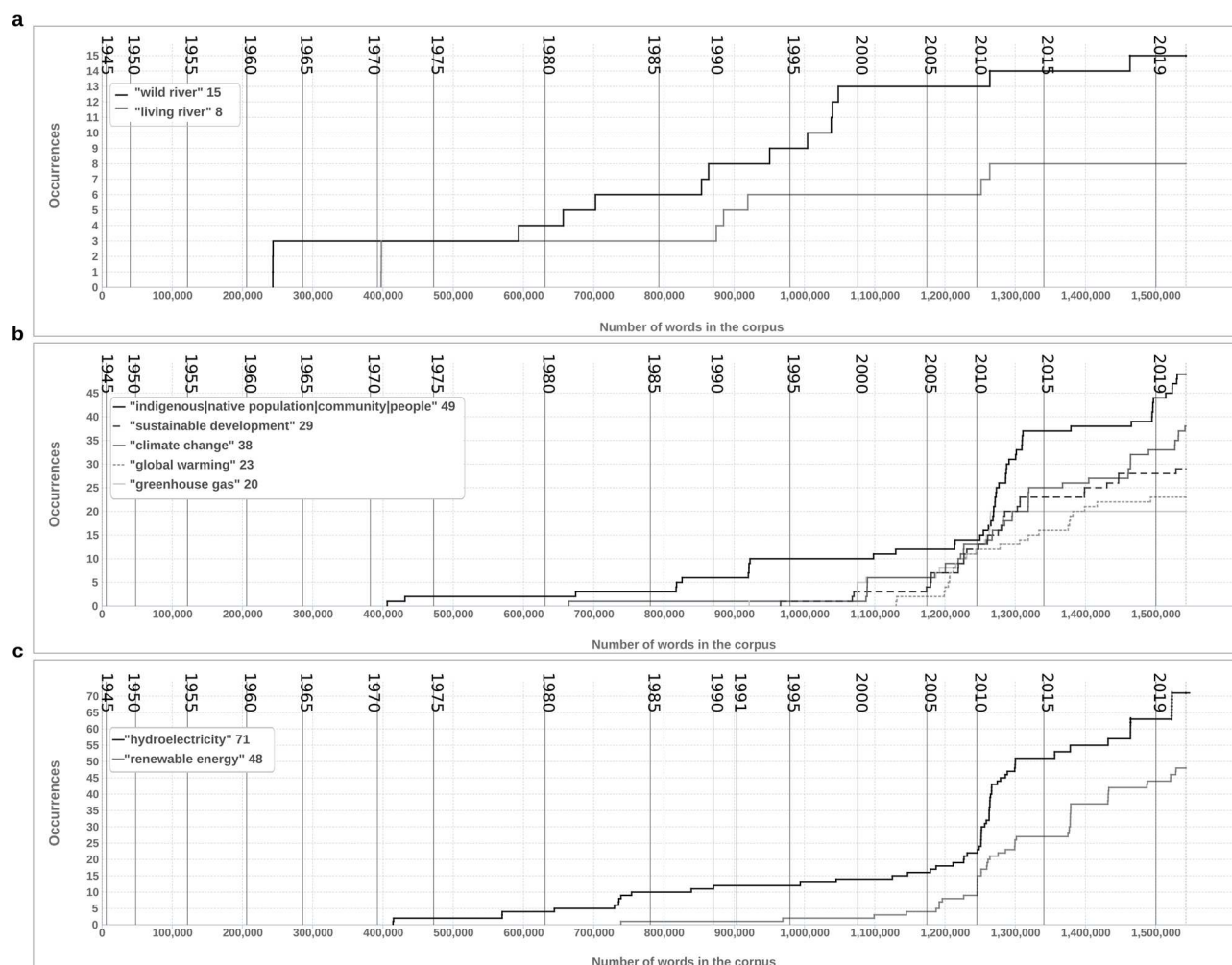
368  
369 While the journalists continued to focus on France or on the dams planned in France, the articles  
370 also turned towards North and South American dams (the most publicised having been Itaipu,  
371 Fig. 2c, on the border between Brazil and Paraguay) and towards some Asian dams. From the  
372 1970s, the negative consequences of dams appeared more and more although some articles  
373 continued to assert the benefits of dams in terms of development. The Oil Crises (which were  
374 evoked in three articles between 1977 and 1979) might have played a role in the latter case. The  
375 debates and controversies were no longer simply local or regional but were national and even  
376 international. The opposition to the Silent Valley Dam in India was described, for example, as part  
377 of a broad campaign to defend tropical environments and in particular tropical forests throughout  
378 the world. The inundation of farmland was increasingly cited (in particular in the Loire valley with  
379 Villerest or Naussac, Fig. 2c, in the centre of France but also in Haïti). By raising this topic, the  
380 journalists questioned both the type of nature desired by society and the economic model dominant  
381 in France and throughout the world. While the foreign dams built with French assistance continued  
382 to specifically attract the attention of journalists (for example, Itaipu, Fig. 2c), compared with  
383 articles of the 1950s and 1960s, the articles of the 1970s and 1980s were much more critical of  
384 French foreign aid. The building of dams on the Senegal River was described as leading to the  
385 “disappearance of subsistence agriculture in favour of the development of export crops” (*Le Monde*,  
386 15<sup>th</sup> October 1983). Ongoing and past debates on American dams— the O’Shaughnessy in the  
387 Hetch Hetchy Valley or the Marble Canyon on the Colorado River—were evoked.

388  
389 In some articles, dams became synonymous with environmental degradation and destruction. Since  
390 its inauguration in 1971, the Aswan High Dam has remained newsworthy (Fig. 2c) because of its  
391 negative impacts: the increase in soil salinity, river bank erosion, the disappearance of certain  
392 species such as sardines (*Sardina pilchardus*), and the regression of the Nile’s delta. In recent  
393 articles, Aswan has become a symbol of negative consequences of dams, in particular for arid

394 countries. More attention was also paid to rivers in terms of pollution, yield, temperature, and algae  
395 development. Subjects such as hydro-peaking, flushing flows, and discontinuity became  
396 newsworthy. For some journalists, once the dams were built, the nature of the river changed. The  
397 Verdon River (in the Southern French Alps) “has ceased to exist for a third of its distance” (*Le*  
398 *Monde*, 28<sup>th</sup> June 1982), for example, and the Tagus (in Central Spain) was “imprisoned by a series  
399 of dams” (*Le Monde*, 12<sup>th</sup> March 1971). During this period, the expressions “wild river” and “living  
400 river” appeared in journalistic vocabulary (Fig. 5a), which revealed the growing concern for pristine  
401 and rare environments. Starting in the 1980s, some articles focused on or evoked plans for dams,  
402 which were cancelled because of environmental considerations in France but also in Germany,  
403 Australia, the United States and the Soviet Union.

404  
405 According to *Le Monde*, dams became particularly controversial hydraulic infrastructures during the  
406 1970s and 1980s, although no lexical fields particularly stood out in the corpus. During these two  
407 decades, while environmental concerns emerged, economic and social issues split apart as some  
408 dams were described as economically interesting but socially questionable.

409  
410  
411  
412



**Fig. 5.** Significant keywords and expressions and their evolution between 1945 and 2019. a, Cumulative frequencies of the expressions “wild river” and “living river”. b, Cumulative frequencies of the expressions “indigenous|native population|community|people”, “sustainable development”, “climate change”, “global warming”, “greenhouse gas”. c, Cumulative frequencies of the expressions “hydroelectricity” and “renewable energy”.

### 3.4. From social and environmental impacts to controversies on sustainability (1990s-2010s)

#### 3.4.1. A discourse on the impact of dams on water and physical environment and their interactions with society (1990s-mid 2000s)

During the 1990s and the beginning of the 2000s, the coverage of issues related to dams slightly decreased in *Le Monde* (Fig. 1d). Nonetheless, environmental protests became more topical during the 1990s in relation to specific debates (for example, the Three Gorges project in China, Fig. 2c). The social and environmental impacts of dams continuously appeared—although the tone of the

428 journalists remained neutral in general. Impact on water (quality and quantity) also became more  
429 central (Fig. 4).

430

431 The introduction of such topics in the newspaper's accounts were linked to various events. Firstly,  
432 in 1992 the French government passed a water law and defined water as a national heritage.  
433 Secondly, at the end of the 1990s, some members of the French government considered  
434 implementing a sustainable water development scheme for the Loire River basin. At the end of the  
435 1990s, such a program implied abandonment of dam projects, with an important example being the  
436 Chambonchard Dam (*Le Monde*, 19<sup>th</sup> February 1999). It represented a major turn for water  
437 development in France, as dam projects were cancelled due to environmental concerns and protests.  
438 Thirdly, the newspaper also highlighted newly discovered environmental impacts of dams, in  
439 particular the biological consequences of the release of methylmercury after the flooding of forests  
440 or boglands in Canada (*Le Monde*, 27<sup>th</sup> December 1991) or the release of greenhouse gas. The  
441 newspaper's columns debated the latter, when the main French operator *Électricité de France*  
442 (EDF) was obliged to temporarily shut down its newly inaugurated dam and power plant of Petit  
443 Saut in French Guyana. The flooded tropical forest released so much methane that many fish  
444 suddenly died. Scientific studies demonstrating that the reservoir released important quantities of  
445 greenhouse gas that were quoted by the newspaper led journalists to conclude that "hydroelectric  
446 dams are not insignificant in terms of greenhouse effect" (*Le Monde*, 28<sup>th</sup> August 1995). The subject  
447 of greenhouse gas was introduced in some articles on dams since the early 1990s (Fig. 5b) but only  
448 became topical at the end of the 1990s and even more so after 2004.

449

#### 450 3.4.2. When sustainability enters the discourse on dams (from the mid-2000s)

451

452 Although international conferences and reports introduced the concept of sustainable development  
453 at the turn of the 1990s (with the 1987 report *Our Common Future* and the 1992 Rio Earth Summit),  
454 based on *Le Monde*'s reporting, the sustainability of dams only became central in the discourses on  
455 dams after the mid-2000s. The expression "sustainable development" appeared regularly since 2005  
456 (Fig. 5b). Similarly, the use of the expressions "climate change", "global warming" and  
457 "sustainability" increased substantially after 2004 (Fig. 5b), possibly in relation to the 2001 Third  
458 Assessment Report of the Intergovernmental Panel on Climate Change. Economic development was  
459 tightly linked to environmental and social sustainability, as shown in the class 8 (Fig. 3), which  
460 gained momentum in the last decade (Fig. 4). Sustainability was shown as a paradigm for  
461 development and for water management that can be invoked to either defend or criticise dams.

462 Livelihoods, living standards, social equity and justice and human rights were more and more  
463 reported on after 2000 (Fig. 4). *Le Monde* participated in giving indigenous communities an  
464 international audience (Fig. 5b), in particular in the cases of Southeastern Asian dams (such as  
465 Murum in Malaysia) or of South and North American dams (such as Belo Monte in Brazil, Fig. 2b  
466 or Agua Zarca in Honduras, or various Canadian projects), which may endanger these communities'  
467 livelihoods, according to the newspaper.

468

469 The newspaper also explained, however, how different projects may contribute to sustainability. *Le*  
470 *Monde* reported that the Nam Theun 2 project, planned in Laos, was defended by the World Bank—  
471 although the World Bank had previously refused to finance some other dam projects—and  
472 presented by the international institution as an example of sustainable development (*Le Monde*, 14<sup>th</sup>  
473 September 2004). The construction of the multipurpose Kandadji Dam on the Niger River in the  
474 South of Niger was also said to have raised no opposition “because the dam was conceived  
475 according to the standards of sustainability” (*Le Monde*, 10<sup>th</sup> May 2012). Instead, the story of an  
476 irrigation dam planned on the Acheloos River in Greece, was reported in the newspaper after the  
477 decision taken by the Greek Council of State (i.e., the Supreme Administrative Court) to prohibit  
478 the dam’s construction as the project contradicted the principles of sustainability recognised by the  
479 Greek constitution (*Le Monde*, 6<sup>th</sup> March 2014). In many recent articles focusing on China (which is  
480 the second most newsworthy country, Fig. 2a and Fig. 2b), the journalists argued that sustainability  
481 has entered the discourse of Chinese officials. This discourse focused on justifying the building of  
482 new dams when, in fact, the multiplication of dams and the accompanying growth and climate  
483 change “put pressure on hydrology” (*Le Monde*, 12<sup>th</sup> November 2008). The Three Gorges Dam,  
484 proposed by the Chinese government who “assured that such construction work is essential for the  
485 modernisation of a country where energy shortages are slowing development” (*Le Monde*, 16<sup>th</sup>  
486 December 1994), in fact “amplifies the consequences of global warming which has already  
487 contributed to diminishing the Yangzi River’s yield” (*Le Monde*, 30<sup>th</sup> December 2009). While  
488 irrigation represented a controversial topic, as demonstrated by the debates on the Sivens Dam  
489 project in Southwest France (Fig. 2c), “sustainable”, “development” and “renewable” are amongst  
490 words that co-occurred most with the word “hydroelectricity” in the newspaper corpus. Although  
491 hydropower remained much less articulated as a theme connected to dam building than it was in the  
492 1940s and 1950s, hydroelectricity became more topical in the newspaper also at the turn of the  
493 second millennium (Fig. 5c). The newspaper revealed the complexity of the debate. While  
494 indicating the possibility of greenhouse gas release related to certain dam-reservoirs, it also  
495 explained that after “the Fukushima accident, the questioning on nuclear power and the struggle

496 against greenhouse gas emissions should speed up the scramble to large infrastructures” (*Le Monde*,  
497 19<sup>th</sup> April 2011). The journalists covered explicitly the return to large infrastructures, especially in  
498 developing countries. While reporting on a meeting between the African Union and ICOLD,  
499 journalists explained that hydropower is presented as a clean “alternative to fossil energy resources”  
500 and the organisations’ “intentions are clear: large dams must become once again instruments for the  
501 development of nations” (*Le Monde*, 27<sup>th</sup> November 2008). The journalists also highlighted,  
502 however, that this return to large infrastructures can be a source of major political tensions, for  
503 example in the case of the Great Ethiopian Renaissance Dam, which the newspaper has very often  
504 reported on in recent years (Fig. 2c). By 2019, with the rise of an environmental discourse on  
505 economic, social and environmental sustainability, and the emergence of themes such as climate  
506 change, global warming and greenhouse gas emissions, the reporting on dams has therefore become  
507 more ambiguous and associated with uncertainty.

508

#### 509 **4. Discussion**

510

511 Despite the fact that *Le Monde* does not specialise in environmental issues, the results of the  
512 analysis showed that the newspaper documented changes in discourses on hydraulic infrastructures  
513 such as dams. It provided insights on a continuing dilemma over the period and into the future: to  
514 dam or not to dam? Although dams have been controversial infrastructures as early as the 1940s, it  
515 was mostly after the 1970s that they were portrayed as disrupting social and environmental  
516 configurations, the daily living environments of the local inhabitants. From this point of view, the  
517 results showed a time gap between the scientific controversy on the impact of dams, which emerged  
518 during the 1960s at conferences such as the Royal Geographical Society symposium on “Man-made  
519 lakes” (in 1965), and the media and political debate. The necessity to take into account the local  
520 population and conduct impact assessments, which was proposed by the scientific community at the  
521 beginning of the 1970s (Scope, 1972), was not advanced in newspaper articles of *Le Monde* until  
522 later years of the same decade. The characterisation of dams and hydropower as ‘clean’ and ‘green’,  
523 which has been debated within the scientific community since the 1990s (Rosenberg et al., 1995),  
524 only appeared in the media in the mid-2000s. Moreover, while Allan (2003, p. 2) underlined that  
525 “the water sector in the North adopted the principles of sustainable development during a protracted  
526 discursive struggle from the late 1950s to the mid-1970s”, the issue of sustainability only  
527 progressively emerged in newspaper articles in the 1970s and only became a prominent topic,  
528 conceptualised as such, in the past decade.

529

530 These results are similar to those of other studies on media coverage of environmental issues. In a  
531 study of the coverage of climate change in the mass-media of the United States, Boykoff and  
532 Boykoff (2007) explained that “Even though scientists had warned for years that emissions of  
533 carbon dioxide and other greenhouse gases would lead to changes in the Earth’s climate, this did  
534 not capture large-scale media attention in the US until 1988” (p. 1195). The time gap is also  
535 explainable by events not directly connected with dams, but which triggered a sudden interest in  
536 such infrastructure and its sustainability. In France, in the mid-2000s, the government organised a  
537 multi-party debate on ecology and sustainable development (*‘Grenelle Environnement’*), whose aim  
538 was to elaborate a list of measures to implement. In 2002, the name of the Ministry for Environment  
539 (*‘Ministère de l’Environnement’*), which had kept the same name since 1971, was changed to  
540 ‘Ministry for Ecology and Sustainable Development’ (*‘Ministère de l’Écologie et du*  
541 *Développement Durable’*). These political events could potentially explain the growing interest in  
542 the sustainability of dams in the mid-2000s. As Boykoff and Boykoff (2007) underlined, increases  
543 in the media coverage of environmental topics are often attributable to “a combination of  
544 circumstances that [are] far from purely scientific in nature” (p. 1196).

545

546 From both a genealogical and critical perspective, results of this study showed that, until the 1970s,  
547 *Le Monde* produced and conveyed a discourse highlighting human domination over nature. This  
548 discourse mostly promoted development and paid much attention to the infrastructures themselves.  
549 From the end of the Second World War to the 1970s, the media’s discourse can essentially be  
550 described as ‘Promethean’ or ‘Modernist’ (Kaika, 2006), i.e., a discourse about taming and  
551 controlling a ‘savage’ nature (Boelens et al., 2019). With a strong focus on industrial development,  
552 the newspaper also highlighted the dependency of capitalist States and companies on the building of  
553 new dams and hydraulic infrastructure. In this perspective, dams appeared as ‘hydraulic fixes’—in  
554 other words, hydraulic projects branded by their supporters as tools for growth, social and economic  
555 development, but which in fact contribute essentially to the longevity of hydraulic companies and  
556 capitalist States (Swyngedouw, 2015). Evidenced in articles published after the 1970s, the  
557 newspaper had apparently distanced itself from the Promethean discourse and adopted a more  
558 critical tone. The media began to pay more attention to human livelihoods but also to other  
559 nonhuman living beings. The evolution of the newspaper’s discourses illustrates how dams have  
560 become the ‘symbol of an exogenous development model that is imposed on vulnerable local  
561 societies’ (Barraud, 2008: 3)<sup>2</sup>.

---

<sup>2</sup> Translated from French by the authors.

562

563 The genealogical approach utilised in this study also revealed how sustainability has entered the  
564 discourse on dams and shows a coexistence of different conceptions of sustainability. Although  
565 different stakeholders seemingly agree today that sustainability involves three constituent  
566 elements—ecology, economy and society—the newspaper articles showed changing prioritisations  
567 of these three elements (equitability, viability, bearability). The articles of the 1970s and the 1980s,  
568 for example, highlighted the opposition between stakeholders who favoured economy and who  
569 expressed few concerns regarding ecology—putting forward dams as equitable development  
570 levers—and stakeholders concerned with social changes related to dams, and finally an emerging  
571 group of stakeholders concerned with ecological issues. By the 2010s, sustainability was apparently  
572 central to stakeholders on all sides—i.e., against or in favour of dams—and the environmental  
573 impact of energy infrastructures in particular was brandished by both dam proponents and dam  
574 opponents. For some stakeholders—in particular for some governments or hydraulic institutions—  
575 the articles showed that sustainability was more connected with social and economic aspects than  
576 with environmental ones. More generally, the tension between the different pillars of sustainability  
577 and the consequences of dams at different scales (e.g., local, national, and global) underlines the  
578 importance of deliberation in order to move towards concerted decision-making. It also reveals the  
579 extent to which the sustainability of dams, and notably the criteria we use to define viability (the  
580 opposition between river ecology conservation and carbon emission control) and equitability, has  
581 today become extremely controversial in the public domain.

582

## 583 **5. Conclusions**

584

585 In conclusion, analysis of media discourses held on dams since the mid-20<sup>th</sup> century revealed how  
586 different generations of debates on dams, water planning and more generally on development  
587 paradigms have emerged and evolved. Results of the genealogical study of the newspaper *Le*  
588 *Monde* provided answers to the research questions posed in this paper as follows:

589

590 First, how have the discourses and debates on dams, and notably on the sustainability of dams,  
591 developed within the public domain?

592 Our analysis shows that between 1945 and 2019, different discourses have been developed on dams.  
593 Until the 1960s, the dominant discourse focused on the materiality of dams and their economic and  
594 energy performances. Essentially Promethean, this discourse was occasionally opposed to a  
595 discourse presenting dams as controversial and having negative social and cultural impacts. During

596 the 1970s and the 1980s, i.e., a decade after the beginning of the scientific controversy on dams, the  
597 discourse on dams increasingly added value to the socio-natural environment and landscape  
598 affected by dam projects; dams tended to be presented as economically interesting but socially and  
599 even environmentally questionable. After the 1990s, the impacts of dams were more and more  
600 highlighted, in relation to society and to the physical environment. Finally, our results showed the  
601 extent to which the debate on the sustainability of dams has gained momentum during the past ten  
602 years.

603 However, the notion of sustainability was addressed in newspaper articles on dams in an ambivalent  
604 way. On one hand, negative social and environmental impacts of dams were listed to demonstrate  
605 that dams are incompatible with sustainability. On the other hand, the newspaper articles explained  
606 how in some cases hydropower projects could contribute to sustainable development.

607

608 Second, how can tracing a ‘genealogy’ of discourses on dams inform their sustainability into the  
609 future?

610 Analysing past and present discourses on dams can help inform future discussions on dams and  
611 their sustainability. Our results have shown that controversies about dams are not new in the public  
612 domain, and that the notion of sustainable development has to some extent reactivated the  
613 Promethean discourse in which dams are presented as solutions to a range of socio-environmental  
614 problems. Commonalities between past and present discourses can be found, even though the  
615 Promethean discourse is no longer dominant in the media we analysed.

616 The analysis of media discourses on dams also showed the complexity of the public debate  
617 regarding the knowledge of the social and ecological impacts of dams, of both short-term and long-  
618 term environmental alterations they may cause, and of the political choices to be made in the future.

619 To gain more complete insights and continue informing discussions on dams and sustainability,  
620 future work can extend to other media sources, as archives are becoming more and more digitised.  
621 Additional sources may reveal different trends in the evolution of discourses on dams and the  
622 integration of sustainability within these discourses. Other avenues may include exploration of the  
623 sustainability of dams as producing ‘green energy’, as well as the study of other sources, notably the  
624 advertisements (e.g., leaflets, posters, etc.) produced by hydropower companies. Results from this  
625 study further suggest a need for a stronger dialogue between the scientific and public domains.

626 Knowledge transfer and exchange would be beneficial on topics including the meaning of  
627 ‘renewable energy’ and ‘green energy,’ and alternative modes of governance regarding dams.

628

629 **6. References**

- 630 Adger, W.N., Benjaminsen, T.A., Brown, K., Svarstad, H., 2001. Advancing a Political Ecology of  
631 Global Environmental Discourses. *Development and Change* 32, 681–715.  
632 <https://doi.org/10.1111/1467-7660.00222>
- Ahlers, R., Budds, J., Joshi, D., Merme, V., Zwartveen, M., 2015. Framing hydropower as green energy: assessing drivers, risks and tensions in the Eastern Himalayas. *Earth System Dynamics* 6, 195–204. <https://doi.org/10.5194/esd-6-195-2015>
- Allan, T., 2003. IWRM/IWRAM: a new sanctioned discourse. *SOAS Water Issues Study Group* 50, 1–27.
- Baghel, N., 2010. Discussing Large Dams in Asia After the World Commission on Dams: Is a Political Ecology Approach the Way Forward? 3, 18.
- Beaudouin, V., 2016. Statistical Analysis of Textual Data: Benzécri and the French School of Data Analysis. *Glottometrics* 33, 56–72.
- Best, J., 2019. Anthropogenic stresses on the world’s big rivers. *Nature Geosci* 12, 7–21. <https://doi.org/10.1038/s41561-018-0262-x>
- 633 Boelens, R., Hoogesteger, J., Swyngedouw, E., Vos, J., Wester, P., 2016. Hydrosocial territories: a  
634 political ecology perspective. *Water International* 41, 1–14.  
635 <https://doi.org/10.1080/02508060.2016.1134898>
- 636 Boelens, R., Shah, E., Bruins, B., 2019. Contested Knowledges: Large Dams and Mega-Hydraulic  
637 Development. *Water* 11, 416. <https://doi.org/10.3390/w11030416>
- Boyer, A.-L., Vaudor, L., Le Lay, Y.-F., Marty, P., 2021. Building Consensus? The Production of a Water Conservation Discourse Through Twitter: The Water use it Wisely Campaign in Arizona. *Environmental Communication* 15, 285–300. <https://doi.org/10.1080/17524032.2020.1821743>
- Boykoff, M.T., Boykoff, J.M., 2007. Climate change and journalistic norms: A case-study of US mass-media coverage. *Geoforum, Theme Issue: Geographies of Generosity* 38, 1190–1204. <https://doi.org/10.1016/j.geoforum.2007.01.008>
- Brossard, D., Shanahan, J., McComas, K., 2004. Are Issue-Cycles Culturally Constructed? A Comparison of French and American Coverage of Global Climate Change. *Mass Communication and Society* 7, 359–377. [https://doi.org/10.1207/s15327825mcs0703\\_6](https://doi.org/10.1207/s15327825mcs0703_6)
- Brundtland, G.H., 1987. Report of the World Commission on environment and development: Our common future. United Nations.
- Burgess, J., 1990. The Production and Consumption of Environmental Meanings in the Mass Media: A Research Agenda for the 1990s. *Transactions of the Institute of British Geographers* 15, 139–161. <https://doi.org/10.2307/622861>

- Chin, A., Fu, R., Harbor, J., Taylor, M. P., & Vanacker, V. (2013). Anthropocene: human interactions with earth systems. *Anthropocene* 1, 1-2. <https://doi.org/10.1016/j.ancene.2013.10.001>
- Collier, M., Webb, R.H., Schmidt, J.C., 1996. Dams and rivers: primer on the downstream effects of dams. USGS circular 1126: 94.
- Comby, E., Le Lay, Y.-F., Piégay, H., 2019. Power and Changing Riverscapes: The Socioecological Fix and Newspaper Discourse Concerning the Rhône River (France) Since 1945. *Annals of the American Association of Geographers* 109, 1671–1690. <https://doi.org/10.1080/24694452.2019.1580134>
- Conway, D., Dalin, C., Landman, W.A., Osborn, T.J., 2017. Hydropower plans in eastern and southern Africa increase risk of concurrent climate-related electricity supply disruption. *Nat Energy* 2, 946–953. <https://doi.org/10.1038/s41560-017-0037-4>
- Cottet, M., Piola, F., Le Lay, Y.-F., Rouifed, S., Rivière-Honegger, A., 2015. How environmental managers perceive and approach the issue of invasive species: the case of Japanese knotweed s.l. (Rhône River, France). *Biol Invasions* 17, 3433–3453. <https://doi.org/10.1007/s10530-015-0969-1>
- Crow-Miller, B., Webber, M., Molle, F., 2017. The (re) turn to infrastructure for water management? *Water Alternatives* 10.
- Crutzen, P., 2002. Geology of mankind. *Nature* 415. <https://doi.org/10.1038/415023a>
- de Loë, R.C., 1999. Dam the news: Newspapers and the Oldman River Dam project in Alberta. *Journal of Environmental Management* 55, 219–237.
- Di Baldassarre, G., Mazzoleni, M., Rusca, M., 2021. The legacy of large dams in the United States. *Ambio*. <https://doi.org/10.1007/s13280-021-01533-x>
- Di Baldassarre, G., Wanders, N., AghaKouchak, A., Kuil, L., Rangelcroft, S., Veldkamp, T.I.E., Garcia, M., van Oel, P.R., Breinl, K., Van Loon, A.F., 2018. Water shortages worsened by reservoir effects. *Nat Sustain* 1, 617–622. <https://doi.org/10.1038/s41893-018-0159-0>
- Downs, A., 2016. Up and down with ecology: The “issue attention cycle,” in: Protess, D., McCombs, M.E. (Eds.), *Agenda Setting: Readings on Media, Public Opinion, and Policymaking*. Routledge, pp. 38–50.
- 638 Dryzek, J.S., 2012. *The Politics of the Earth: Environmental Discourses*, Third Edition. ed. Oxford  
639 University Press, Oxford, New York.
- 640 Duarte-Abadía, B., Boelens, R., Roa-Avendaño, T., 2015. Hydropower, Encroachment and the Re-  
641 patterning of Hydrosocial Territory: The Case of Hidrosogamoso in Colombia. *Human*  
642 *Organization* 74, 243–254. <https://doi.org/10.17730/0018-7259-74.3.243>

- Fletcher, R., 2010. When environmental issues collide: climate change and the shifting political ecology of hydroelectric power. *Peace and Conflict Review* 5, 14–30.
- Foucault, M., 1971. *L'ordre du discours: leçon inaugurale au Collège de France prononcée le 2. décembre 1970*. Gallimard, Paris.
- 643 Foxwell-Norton, K. and Lester, L., 2017. Saving the Great Barrier Reef from disaster, media then  
644 and now. *Media, Culture & Society* 39(4), 568-581.
- Fung, Z., Pomun, T., Charles, K.J., Kirchherr, J., 2018. Mapping the social impacts of small dams: The case of Thailand's Ing River basin. *Ambio* 48, 195–207. <https://doi.org/10.1007/s13280-018-1062-7>
- Gleick, P.H., 2000. A Look at Twenty-first Century Water Resources Development. *Water International* 25, 127–138. <https://doi.org/10.1080/02508060008686804>
- Graf, W.L., 1999. Dam nation: A geographic census of American dams and their large-scale hydrologic impacts. *Water resources research* 35(4), 1305-1311.
- Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., Babu, S., Borrelli, P., Cheng, L., Crochetiere, H., Ehalt Macedo, H., Filgueiras, R., Goichot, M., Higgins, J., Hogan, Z., Lip, B., McClain, M.E., Meng, J., Mulligan, M., Nilsson, C., Olden, J.D., Opperman, J.J., Petry, P., Reidy Liermann, C., Sáenz, L., Salinas-Rodríguez, S., Schelle, P., Schmitt, R.J.P., Snider, J., Tan, F., Tockner, K., Valdujo, P.H., van Soesbergen, A., Zarfl, C., 2019. Mapping the world's free-flowing rivers. *Nature* 569, 215–221. <https://doi.org/10.1038/s41586-019-1111-9>
- Gross, M., 2016. A global megadam mania. *Current Biology* 26, R779–R782. <https://doi.org/10.1016/j.cub.2016.08.050>
- 645 Hajer, M.A., 1995. *The Politics of Environmental Discourse: Ecological Modernization and the*  
646 *Policy Process*. Clarendon Press, Oxford.
- Hansen, A., 2015. News coverage of the environment: a longitudinal perspective, in: Hansen, A., Cox, R. (Eds.), *The Routledge Handbook of Environment and Communication*. pp. 209–220.
- Heiden, S., Magué, J.-P., Pincemin, B., 2010. TXM : Une plateforme logicielle open-source pour la textométrie-conception et développement, in: *Statistical Analysis of Textual Data- Proceedings of 10th International Conference Journées d'Analyse Statistique Des Données Textuelles*. pp. 1021–1032.
- Hommes, L., Boelens, R. and Maat, H., 2016. Contested hydrosocial territories and disputed water governance: Struggles and competing claims over the Ilisu Dam development in southeastern Turkey. *Geoforum* 71, 9-20.

- 647 ICOLD, 2018. World Register of Dams. ICOLD: International Commission on Large Dams, Paris.  
648 [https://www.icold-cigb.org/GB/world\\_register/world\\_register\\_of\\_dams.asp](https://www.icold-cigb.org/GB/world_register/world_register_of_dams.asp)
- 649 Lester, L., 2010. Media and Environment: Conflict, Politics and the News. Polity.
- Magilligan, F.J., Graber, B.E., Nislow, K.H., Chipman, J.W., Sneddon, C.S., Fox, C.A.,  
Kapuscinski, A.R. and Olden, J.D., 2016. River restoration by dam removal: Enhancing  
connectivity at watershed scales. River restoration by dam removal. *Elementa: Science of  
the Anthropocene*, 4.
- Mauri, M., Elli, T., Caviglia, G., Ubaldi, G., Azzi, M., 2017. RAWGraphs: A Visualisation Platform  
to Create Open Outputs, in: Proceedings of the 12th Biannual Conference on Italian SIGCHI  
Chapter, CHItaly '17. ACM, New York, NY, USA, p. 28:1-28:5.  
<https://doi.org/10.1145/3125571.3125585>
- McCully, P., 2001. Silenced Rivers: The Ecology and Politics of Large Dams, Enlarged&Updated  
edition. ed. Zed Books, London ; New York.
- Nilsson, C., 2005. Fragmentation and Flow Regulation of the World's Large River Systems. *Science*  
308, 405–408. <https://doi.org/10.1126/science.1107887>
- Nüsser, M., Baghel, R., 2017. The emergence of technological hydroscares in the Anthropocene:  
Socio-hydrology and development paradigms of large dams. in: Warf, B (Ed.), Handbook on  
geographies of technology. Edward Elgar Publishing, pp. 287-301.
- Palmer, M.A., Reidy Liermann, C.A., Nilsson, C., Flörke, M., Alcamo, J., Lake, P.S., Bond, N.,  
2008. Climate change and the world's river basins: anticipating management options.  
*Frontiers in Ecology and the Environment* 6, 81–89. <https://doi.org/10.1890/060148>
- Poff, L.N., Allan, J.D., Bain, M.B., Karr, J.R., Prestegard, K.L., Richter, B.D., Sparks, R.E.,  
Stromberg, J.C. 1997. The natural flow regime: a paradigm for river conservation and  
restoration. *Bioscience* 47, 769–784.
- Power, M., Dietrich, W.E., Finlay, J.C. 1996. Dams and downstream aquatic biodiversity: potential  
food web consequences of hydrologic and geomorphic change. *Environmental Management*  
20, 887–895.
- Ratinaud, P., Déjean, S., 2009. IRaMuTeQ: implémentation de la méthode ALCESTE d'analyse de  
texte dans un logiciel libre. *Modélisation Appliquée aux Sciences Humaines et Sociales*  
MASHS 8–9.
- Reinert, M., 1990. Alceste une méthodologie d'analyse des données textuelles et une application:  
Aurelia De Gerard De Nerval. *Bulletin de méthodologie sociologique* 26, 24–54.
- Reinert, M., 1983. Une méthode de classification descendante hiérarchique : application à l'analyse  
lexicale par contexte. *Cahiers de l'Analyse des Données* 187–198.

- 650 Roe, A., 2012. Riverine Environments, in: McNeill, J.R., Stewart, E. (Eds.), *A Companion to*  
651 *Global Environmental History*. John Wiley & Sons, Ltd, pp. 297–318.  
652 <https://doi.org/10.1002/9781118279519.ch17>
- Rollet, A.J., Piégay, H., Bornette, G., Dufour, S., Lejot, J., Persat, H., 2014. Assessment of consequences of sediment deficit on a gravel river bed downstream of dams in restoration perspectives: application of a multicriteria, hierarchical and spatially explicit diagnosis. *River Research and Applications*. 30(8), 939–953.
- Rosenberg, D., Bodaly, R.A., Usher, P.J., 1995. Environmental and social impacts of large scale hydroelectric development: who is listening? *Global Environmental Change* 5, 127–148. [https://doi.org/10.1016/0959-3780\(95\)00018-J](https://doi.org/10.1016/0959-3780(95)00018-J)
- Scope, 1972. *Man-made lakes as modified ecosystems*. International Council of Scientific Unions, Paris.
- Skalak, K.J., Benthien, A.J., Schenk, E.R., Hupp, C.R., Galloway, J.M., Nustad, R.A., Wiche, G.J., 2013. Large dams and alluvial rivers in the Anthropocene: The impacts of the Garrison and Oahe Dams on the Upper Missouri River. *Anthropocene, Geomorphology of the Anthropocene: Understanding The Surficial Legacy of Past and Present Human Activities* 2, 51–64. <https://doi.org/10.1016/j.ancene.2013.10.002>
- United Nations, 2002. *Report of the World Summit on Sustainable Development*, Johannesburg, South Africa, 26 August–4 September 2002. Presented at the World Summit on Sustainable Development (2002: Johannesburg, South Africa), UN.
- Warner, J.F., Hoogesteger, J., Hidalgo, J.P., 2017. Old Wine in New Bottles: The Adaptive Capacity of the Hydraulic Mission in Ecuador. *Water Alternatives* 10, 19.
- Wei, J., Wei, Y., Western, A., 2017. Evolution of the societal value of water resources for economic development versus environmental sustainability in Australia from 1843 to 2011. *Global Environmental Change* 42, 82–92. <https://doi.org/10.1016/j.gloenvcha.2016.12.005>
- Wei, J., Wei, Y., Western, A., Skinner, D., Lyle, C., 2015. Evolution of newspaper coverage of water issues in Australia during 1843–2011. *Ambio* 44, 319–331. <https://doi.org/10.1007/s13280-014-0571-2>
- Williams, M., Zalasiewicz, J., Davies, N., Mazzini, I., Goiran, J.-P., Kane, S., 2014. Humans as the third evolutionary stage of biosphere engineering of rivers. *Anthropocene* 7, 57–63. <https://doi.org/10.1016/j.ancene.2015.03.003>
- World Commission on Dams, 2000. *Dams and development: A new framework for decision-making: The report of the World Commission on Dams*. Earthscan.

Zarfl, C., Lumsdon, A.E., Berlekamp, J., Tydecks, L., Tockner, K., 2015. A global boom in  
hydropower dam construction. *Aquat Sci* 77, 161–170. <https://doi.org/10.1007/s00027-014-0377-0>

653

654 **Competing interests**

655 The authors declare no competing interests.

656

657