

Identifying evolving priorities in national river governance from Parliamentary Questions

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ABSTRACT

Rivers and their surrounding land provide resources and services that result in trade-offs requiring legislative and institutional interventions, for which the perspectives of law-policymakers and their societal values and political expediencies play a major role in decision-making. This study critically evaluates the evolving land–river governance in large democratically elected governments with complex developmental priorities and how law-policymakers' recognition of emerging issues of river management influences common pool environmental resources governance. We selected an emerging economy – India – and analysed Parliamentary Questions (PQs) between 1999 and 2020 using a mixed method approach. Conflicting priorities over economic development, pollution management, socio-cultural values and inter-state–centre issues shape the evolving priorities of land–river governance. A declining focus on large-scale dams coupled with increasing attention on inter-basin water transfers, river conservation and pollution abatement, demonstrates an evolution away from the earlier narrow view of rivers for irrigation and hydropower. Our analysis demonstrates how the priorities of law-policymakers and political expedience play a critical role in river governance and thereby provide important insights into common pool environmental resources governance for sustainable development while also identifying important knowledge gaps and suggesting scopes for interdisciplinary studies.

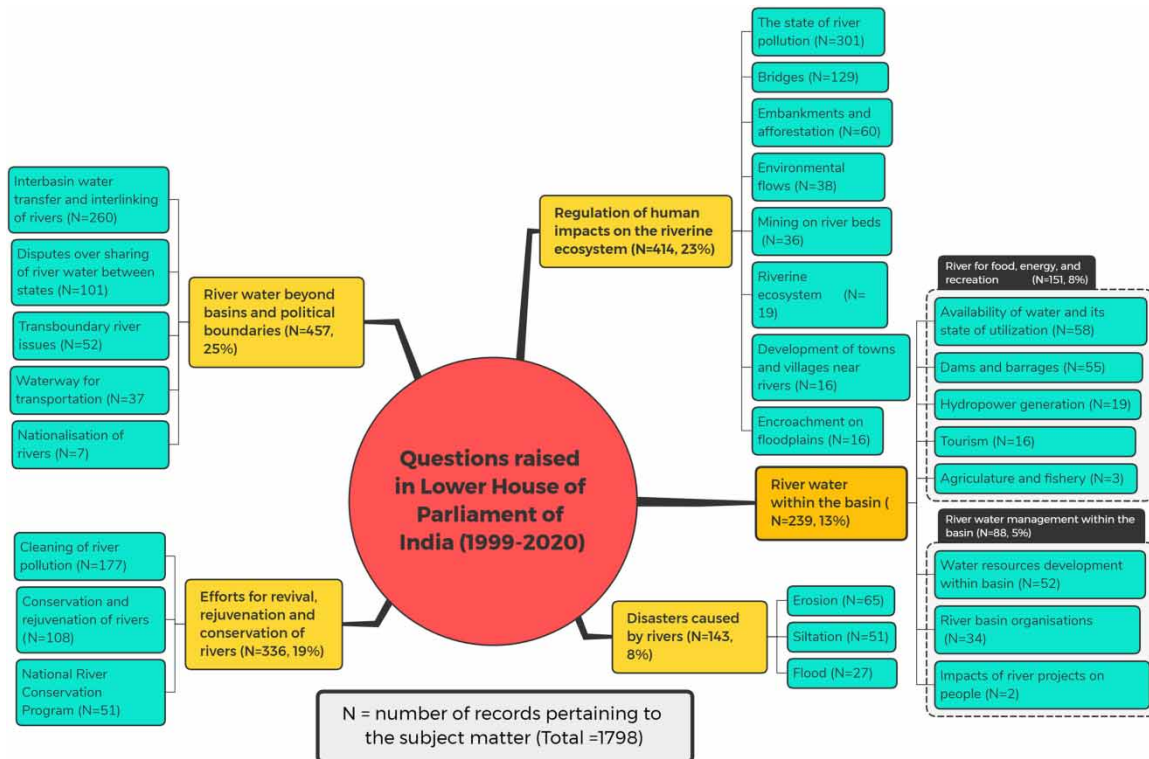
Key words: Law-policymakers, Legislative approach, Parliament, Pollution management, River-environmental governance, Sustainable development

HIGHLIGHTS

- Analysed Indian Parliamentary Questions concerning rivers over two decades.
- Evolving societal values, priorities and political pressures represented.
- Declining focus on dams and large-scale reservoirs; indicating a shift from an earlier era of viewing rivers narrowly for irrigation and hydropower.
- Indian Parliamentarians are paying increasing attention to inter-basin water transfers, river conservation and pollution.

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GRAPHICAL ABSTRACT



1. INTRODUCTION

Rivers, and the management of water, play a critical role in human civilization (Macklin & Lewin, 2015; Haidvogel, 2018). Rivers provide not only water and energy for domestic and industrial use and irrigation but also nutrients for agriculture through floods (e.g., Li *et al.*, 2021), and hence humans have exploited rivers for food, water and energy security. Rivers support navigation and transportation (Castonguay, 2017) with human settlements developing along their banks (Macklin & Lewin, 2015; Li *et al.*, 2021), enhancing the economic value of land surrounding rivers. With the emergence of the industrial society, rivers have increasingly become the rallying point of contention between sovereign states, regions, individuals and localities (Wirsing & Jasparro, 2007; Uprety & Salman, 2011; Xie & Jia, 2016), due to pollution, impoundment for hydroelectricity generation, abstraction, etc. The politics and governance of rivers have caused a dispute with many international treaties and national legislations enacted to promote the harmonious utilization of river resources (Huber & Joshi, 2015; Xie & Jia, 2016).

A key challenge to the integrated management of rivers (Grabowski *et al.*, 2022) is the lack of consensus on what constitutes river 'development' (Legendijk, 2019). For example, a geomorphologist may understand 'river development' as a natural morphological evolution of the riverbed (Vandenberghe, 1995) and engineers apply the term to the building of infrastructure for storage and abstraction (Best, 2019; Legendijk, 2019) or water treatment (e.g. Yang *et al.*, 2016), while ecologists and conservationists may mean river development as the ecological flourishing of the river ecosystem (Chakraborty, 2013). The perceptions of rivers and their ownership

(Hudson-Rodd & Shaw, 2003; Sharma *et al.*, 2020), their role in providing ecosystem services and how they should be governed vary widely across people (Clark *et al.*, 2019a). Studies on the perceptions, understanding and influence of numerous stakeholders in the context of river management [e.g., farmers: (Quintana-Ashwell *et al.* 2022); industrialists; communities living on the riverbanks: (Moench, 2010; Vinca *et al.*, 2020); institutions], largely omit lawmakers (Ching & Mukherjee, 2015; Basco-Carrera *et al.*, 2018; Sullivan *et al.*, 2019). Lawmakers make the greatest, or at least potentially the most powerful, influence on the governance of rivers through the making of laws and policies (Varone *et al.*, 2020). Members of Parliament (MPs) can be considered a ‘community of practice’ defined by Wenger *et al.* 2002, p. 4 (although in the context of managing knowledge) as ‘a group of people who share a common set of problems, or a passion about a topic, and who deepen their knowledge and expertise [or influence others by persuasion] by interacting on an ongoing basis’ and thereby shape the outcomes of lawmaking (page 4). Although policy and lawmakers alone cannot ensure that the governance of rivers enhances sustainable development or maintains the sustainability and integrity of the river for its own sake, without their involvement, other stakeholders cannot effectively ensure that the rivers are managed sustainably.

The way policy- and lawmakers understand and articulate an issue as complex as river governance (Grabowski *et al.*, 2022) or even use it for their specific political agendas in a democratic society has been rarely explored (Schiff, 2014; Bundi, 2018b; Mourao, 2019), particularly in the context of environmental resources management. However, Parliamentarians have been known to use the privilege of Parliamentary Questions (PQs) to evaluate government policies (Bundi, 2018a), seek accountability (Bundi, 2018b) and bring the attention of the executive to focus on their constituency (Martin, 2011). Although PQs have high importance in governance circles and the mass media, little scholarly attention has been paid to their content, trends or how they affect the governance (Voorst & Zwaan, 2019) of natural resources that ultimately affect the sustainable development of society (Schoenefeld & Jordan, 2019). Therefore, this paper aims to draw out the evolving issues of river governance from the perspectives of law- and policymakers in a large, democratically elected form of governance, as reflected by the PQs they raise in an emerging economy – India – mired in complex developmental priorities. We investigate how the depth and richness in the understanding of river systems in India’s lawmakers’ debates and their priorities have changed over the last two decades regarding the governance of rivers and the surrounding land (Vercruyssen *et al.*, 2022) and what it reveals about their current priorities in these issues. Adopting the definition of governance from Bevir (2012; p.1), river governance in this context refers to the various processes of governing or managing rivers, ‘whether undertaken by a government, market, or network, formal or informal organization, or territory, and whether through laws, norms, power or language.’ Thus, it includes the processes that affect how the resources of rivers are utilized or conserved through legislation, persuasion, coercion, or creation and reinforcement of social norms and institutions.

2. CONTEXT, MATERIALS AND METHODS

2.1. Context

The MPs in a democratic country, such as India, frame the laws and legislations, and hence are the ‘lawmakers’, while the ruling government (or the Executive) makes policies for the implementation of those laws and legislations, and hence the ‘policymakers.’ We refer to these as ‘law-policymakers’. Their perceptions of critical, urgent and imperative issues are expressed through the questions raised in the parliament (Bailer, 2011; Martin & Rozenberg, 2014).

In the context of India, the first hour of a sitting of Lok Sabha (LS) (House of People or the Lower House of the Indian Parliament) is devoted to Questions raised by the Members, which is designed to enable the government to

‘feel the pulse of the nation and adapt its policies and actions accordingly’ (Lok Sabha, n.d.). All aspects of administration and governance are raised as Members attempt to elicit pertinent information from the Government (and hold them accountable).

2.2. Data

PQs are either starred or unstarred. Starred questions must be answered by the concerned minister during the parliamentary sittings, whereas unstarred questions are placed on the table to be read by the members themselves. PQs are freely available online (Lok Sabha, n.d.). Records were filtered using the keyword ‘river’ in the title of Questions for LS tenures from the 13th to the 17th (10 October 1999–21 March 2020). Each record consists of the name of the Member(s) of Parliament who raised the question, the Minister to whom the question is addressed, a serial number of the question/record, the type of question – starred or unstarred – and the response of the concerned minister along with the question(s) and annexures if needed. Questions and responses generally consist of two or three pages, with the information being asked mostly framed and subdivided into three or four sub-questions. Out of a total of 314,517 records, 1,798 had the keyword ‘river’ in the title (Table 1). The questions were addressed to 25 different ministries, the majority of which were for the Ministries of Water Resources ($n = 1,041$) and Environment and Forests (and Climate Change; from 16th LS) ($n = 445$) (Supplementary Material, Table A).

Table 1 | A summary of the number of Parliamentary Questions on rivers.

		Parliamentary tenure					Subtotal	%
		13th 10 October 1999–6 February 2004	14th 17 May 2004– 18 May 2009	15th 18 May 2009– 18 May 2014	16th 18 May 2014– 25 May 2019	17th 25 May 2019– 21 March 2020		
Lok Sabha tenures								
	Ruling Political Party	NDA led by BJP	UPA led by Congress	UPA led by Congress	NDA led by BJP	NDA led by BJP		
	(a) Total records	73,424	66,371	79,401	79,149	16,172	314,517	
	(b) ‘River’ in title	357	296	419	573	153	1,798	
	Ratio b:a	1:207	1:228	1:189	1:137	1:107	1:175	
Theme	Description							
Regulation of human impacts on the riverine ecosystem	The state of pollution	30	30	73	130	38	301	35
	Bridges over rivers	43	29	39	14	4	129	
	Embankments and afforestation	6	11	11	24	8	60	
	Environmental flow	6	11	8	11	3	39	
	Mining on riverbeds	7	6	12	6	5	36	
	Riverine ecosystem	1	4	10	8	3	26	
	Development of towns and villages near rivers	1	5	9	0	1	16	
	Encroachment on riverbeds and floodplains	2	3	3	6	2	16	
	Subtotal	96	99	165	199	64	623	

(Continued.)

Table 1 | Continued

		Parliamentary tenure					Subtotal	%
		13th 10 October 1999–6 February 2004	14th 17 May 2004– 18 May 2009	15th 18 May 2009– 18 May 2014	16th 18 May 2014– 25 May 2019	17th 25 May 2019– 21 March 2020		
Lok Sabha tenures	River water beyond basins and political boundaries	70	39	44	80	27	260	25
	Inter-basin water transfer and interlinking of rivers							
	Water sharing and disputes between states	30	18	18	35	0	101	
	Transboundary river issues	10	11	21	10	0	52	
	Waterway for transport	9	5	3	13	7	37	
	Nationalization of rivers	1	1	2	0	3	7	
	Subtotal	120	74	88	138	37	457	
River restoration	Cleaning of pollution	14	18	34	97	14	177	19
	Conservation and rejuvenation of rivers	17	9	31	40	11	108	
	The National River Conservation Program	6	13	9	16	7	51	
	Subtotal	37	40	74	153	32	336	
River water within the basin	Availability of water and its state of utilization	25	19	11	2	1	58	13
	Dams and barrages	18	11	11	11	4	55	
	Water resources development	15	15	14	7	1	52	
	River Basin Organizations	3	1	16	13	1	34	
	Hydropower generation	4	5	6	4	0	19	
	Tourism	3	2	2	7	2	16	
	Agriculture and fishery	0	1	0	1	1	3	
	Impacts of river projects on people	1	1	0	0	0	2	
	Subtotal	69	55	60	45	10	239	
Disasters and rivers	Erosions caused by rivers	18	13	14	16	4	65	8
	Siltation and dredging	14	7	10	18	2	51	
	Floods caused by rivers	3	8	8	4	4	27	
	Subtotal	35	28	32	38	10	143	
	Total	383	283	384	627	148	1,798	100

2.3. Analysis

The records were analysed quantitatively and qualitatively to identify the key issues raised by members. We employed rigorous methods of content analysis (Graneheim & Lundman, 2004; Strijbos *et al.*, 2006; Tang *et al.*, 2013) that consist of classifying, organizing and examining the data to make patterns (Press, 1996; Voinov *et al.*, 2018). The records were first analysed quantitatively (Zheng *et al.*, 2019) by categorizing the records based on the subject matter of the question into various themes to assess the key issues and concerns (Guest *et al.*, 2012) using NVivo 12 (QSR International Pty Ltd, 2018) to arrange the evidence efficiently. The quantitative analysis provided the benefit of covering the breadth – how many, to what extent and how often – whereas the qualitative analysis enhanced the depth of investigation by providing answers to why and how. Many

questions are interrelated and can be grouped under more than one theme but have been categorized thematically based on the title of the question (framed by the questioner) so that the quantification and categorization of questions are consistent, and the summation leads to the total number of questions.

The records were then analysed qualitatively (Saldana, 2009) to understand the intent of the questions, the manner of the usage of the key phrases and the information provided in the responses (Fereday & Muir-Cochrane, 2006; Saldana, 2009; Bryant, 2014). The reliability of the coding process was ensured by using the keyword 'query' feature in NVivo 12 to minimize the potential omission of key points and to ensure that the context in which the keywords occurred is taken into account (with human reasoning) by not relying on the machine intelligence alone. Finally, the evolution of the government's priorities and issues of river governance (Driessen *et al.*, 2012) over the last two decades is analysed.

2.4. Traceability of records

To ensure transparency and traceability, questions are labelled by three identifiers: (a) the tenure of the LS by the Roman numerals XIII, XIV, XV, XVI and XVII, (b) whether the question is 'starred' or 'unstarred' (denoted by * or -) and (c) the official serial number of the question. For example, XVII*74 indicates this information is taken from the 'starred' question number 74 of the 17th LS.

3. FINDINGS

A significant focus on the regulation of human impacts on the riverine ecosystem and river and water management issues between basins is evident (Table 1). Exemplary quotes from the corpus data (1798 PQs) for each of the themes are given in Table B of the Supplementary Material. Over time, there has been a shift in emphasis towards river restoration and ecosystems (Figure 1). Figure 2 shows the frequently occurring words (synonyms included) from the corpus data. Besides the obvious words such as 'water', 'river', 'government' and 'ministry', 'ganga' and 'pollution' were among the most frequently occurring words. The next frequently occurring words are 'rejuvenation' and 'conservation' (mostly in the context of the 'river rejuvenation' projects), 'sewage' (disposal of sewage water into the surface water) and 'development' (often discussed in the context of 'river development' or water resources development). These themes are elaborated in the following subsections.

3.1. Regulation of human impacts on the riverine ecosystem

PQs that pertain to the regulation of anthropogenic activities on the riverine ecosystem were the most asked (about 35% of the total). Questions concerned the state of pollution in rivers ($n = 301$), bridges (129), embankment and afforestation of riverbanks (60), environmental flows ($n = 38$), mining (mostly sand) ($n = 36$) and encroachment ($n = 16$) on riverbeds and floodplains, development of towns and villages near the rivers (16), and general concerns vis-à-vis human impacts on the riverine ecosystem ($n = 26$). Questions concerning the state of river pollution doubled in the 15th ($n = 73$) and 16th ($n = 130$) LS compared to the previous decade ($n = 30$ each in the 13th and 14th LS) and focused on industrial discharges, untreated municipal sewage, religious practices and informal waste dumping. Most of the questions pertained to the Ganges and Yamuna, although a few focused on the Brahmaputra and its tributaries (XVI-1744, XVI-2091 and XVI-2809), including contemporary 'black water' events coming from across the border (XVI-2920) triggered by a pollution incident. Others questioned the effects of pollution on people (e.g., XIV-15, XV-2603 and XV-2355), fishes (XIV-122) and the riverine ecosystem in general ($n = 26$). Questions regarding the arsenic pollution in rivers (XVI-1855, XVI-1444, XVI-1718, XVI-2902 and XVI-1188) were also raised, but the Minister replied that no detectable presence of arsenic was found at any river locations monitored. Some questions are suggestive in nature regarding the policies and schemes of the Government. For example, members asked whether major rivers including Ganga

continue to be 'toxic' despite anti-pollution campaigns and whether the Government has undertaken any review of the anti-pollution campaign (XVI-5464) and punitive actions on those polluting rivers (XVI-1075, XVI-4233 and XVI-4682). A Member questioned (XVI-260) 'whether it has been proved in scientific research that the Ganga River has higher self-purifying capacity than other rivers', a widespread belief.

The questions regarding the flow rates in the rivers ($n = 39$) were mostly raised in the context of river water-sharing disputes between states. While the questions in the 13th, 14th and 15th LS mostly focused on decreased availability of water due to natural/global phenomenon and increased abstractions (e.g., XIII-97, XIII-1010, XIV-1694, XIV-1093, XV-2096 and XV-2146); from question XV-5082 entitled 'Environmental flow of rivers' in the 15th LS, the questions in the 16th LS began to focus on 'environmental' or 'ecological' flows (e.g., XVI-461 and XVI-273) and the interventions of the Court (National Green Tribunal, NGT).

Besides queries concerning bridge construction across the rivers ($n = 129$) and development and afforestation of riverbanks ($n = 60$), questions concerning the development of riverbanks pertain mostly to the construction and modification of riverbanks and embankments for recreational amenities and flood protection (e.g., XIII-332, XVI-921, XVI-1245 and XVII-2672). Instances of scientific studies drawing the attention of the Members (e.g. XIV-2224 and XV-893) and Members asking for more studies were observed. For example, questions concerning the hydrologic response of river systems in the country due to river channelization, flood control, river management for stream bank erosion, catchment area processes and stream flow (XV-2591) and the impact of climate change on river systems in the country (XV-903) were raised.

Riverbed mining ($n = 36$) and encroachment on floodplains ($n = 16$) were other highlighted concerns. The five questions in the first decade (13th and 14th LS) are in relation to developmental and construction activities by the Government on the Yamuna bank with the change of Master Plan Delhi-2001 (XIII-2441) while the questions ($n = 3$) during the 15th LS (in 2012) pertain to shrinking of rivers in general due to riverbed encroachment (XV-3602), riverfront development causing losses to environmental resources (XV-4178) and notifications of River Regulation Area to save riverbed from harmful construction (XV-7245).

3.2. River water beyond the natural basins and political boundaries

Questions in this theme relate to the politics and practicality of sharing and managing rivers across river basins, across and between states and national boundaries. Inter-basin transfers ($n = 260$), sharing of river water between states and related disputes ($n = 101$), issues of transboundary rivers ($n = 52$), inland river navigation ($n = 36$) and questions regarding 'nationalization of rivers' ($n = 6$) made up about one-fourth ($n = 457$) of the identified questions raised in the LS (Table 1). Inter-basin transfers, or the interlinking of rivers, is one of the prominent debates concerning the management of Indian rivers and is intricately linked with the sharing of water between State Governments ($n = 101$). It is also driven by political ideology, with more frequent questions during the Bharatiya Janata Party (BJP)-led NDA Government ($n = 70$ and 80 during the 13th and 16th LS, respectively) compared to the Congress-led UPA Government during the 14th ($n = 39$) and 15th ($n = 44$) LS tenures (Table 1) as the former is in favour.

Questions that advocate the interlinking of rivers imply the benefits in the title, such as 'diversion of excess water of rivers' (XIII*3) and 'floods due to non-interlinking of rivers' (XVII-1083), while Members who question the feasibility of such large engineering projects frame the title as 'diversion of rivers' (XIII-2055) or 'opposition by [a particular State] on rivers linking project' (XIV-680). Questions asked about the environmental impacts of inter-basin water transfers (e.g., XIII-1061 and XVI-752) or on the people (XIV-3790) are discussed in Section 3.3. Other questions asked the Government whether it had studied the interlinking of rivers in other countries (XV-107), to which the Minister denied, or whether the public opinion on it had been evaluated or efforts made to generate public support (XV-4359), which was affirmed by the Minister. A typical response of the Minister

(e.g., XV-944 and XVII-3979) is to cite the 1980 National Perspective Plan (NPP) of the Ministry of Water Resources (erstwhile Ministry of Irrigation) that envisages the transfer of water from the 'surplus' Himalayan river basins to 'deficit' Peninsular river basins.

One question each in the 13th (XIII-80), 14th (XIV-2732) and 15th (XV-4044) LS asked if the Government is contemplating the 'nationalization of rivers' to address the issues of river water disputes and equitable sharing to which the Minister consistently denied. 'Nationalization of rivers' is generally spoken in the context of putting rivers under Federal Government control. Related to the agenda of interlinking rivers and 'nationalization of rivers' is the concept of 'One Nation One River Grid' (XVII-3979), which the proponents argued will not only enhance equitable distribution of water across the country but also promote inland water navigation. The number of questions regarding developing rivers for inland river navigation ($n = 37$) was also more during the 13th ($n = 9$) and 16th ($n = 13$) compared to 14th ($n = 5$) and 15th ($n = 3$) LS when the Questions regarding interlinking rivers and water sharing between States increased. Some Questions regarding the interlinking of rivers are also related to objections raised by neighbouring countries regarding the diversion of the water from the transboundary northern Indo-Gangetic rivers (XIV-1767). However, many transboundary river questions relate to flooding (e.g. XV-3385, XV-655, XV-6794, XIII-1780 and XV-2800), transport of pollutants and the drying up of rivers or not meeting adequate environmental flows due to damming (XIV-3375 and XV-1008) or diversion by other countries (XV*204 and XV-1364).

3.3. Efforts for revival and conservation of rivers

Questions pertaining to the revival, rejuvenation or conservation of rivers made up approximately 19% of the identified questions ($n = 336$ out of 1798). While 108 questions referred to rejuvenation and conservation of rivers in general, 177 questions requested specific information on actions being taken by the Government to 'clean' up the rivers and 51 questions specifically mentioned the National River Conservation Plan/Program (NCRP). The NCRP was launched in 1995, based on the Ganga Action Plan initiated in 1985, to cover other Indian rivers. Its main aim was pollution abatement on a cost-sharing basis between the Centre and State Governments. It included collection, transportation and treatment of municipal sewage, river front development (RFD), and low-cost sanitation (LCS) to improve the water quality of the rivers.

Queries regarding river restoration and cleaning of pollution increased in the 15th and 16th LS ($n = 74$ and 154 respectively) comparing to the previous two (13th $n = 37$ and 14th $n = 40$). Questions with 'cleaning' (of rivers) in the title increased from 14 in the 13th to 97 in the 16th LS. While some questions pertain to the cleaning up of pollution in rivers in general, many questions were concerned with the implementation of the NCRP, priorities for the approved works/projects (XIII*14), number of rivers covered in each of the States (XIII*16), to revamp the Programme (XIV*193) and the costs of the Projects (XIV*295). In response to queries concerning the involvement of State governments, the Minister pointed out that river conservation, being complex and costly undertakings, requires the involvement of all the stakeholders in which the Central Government supplements the efforts of the State Governments. As of 29 August 2011 (XV-4297), the NCRP covers 39 rivers and 185 towns in 20 states. An expenditure of 4,729 crore rupees has been stated to have been incurred and a sewage treatment capacity of 4,417 million litres per day (MLD) has been created so far under the Plan (XV-4297). Creation of infrastructure for sewage management is also being undertaken through other central schemes, such as the Jawaharlal Nehru National Urban Renewal Mission and Urban Infrastructure Development Scheme for Small and Medium Towns, as well as under State schemes and the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) since 25 June 2015 in 500 cities across the country for a period of 5 years i.e., from 2015–16 to 2019–20 with a focus on the development of basic urban infrastructure in the mission cities (XVII-4315). The Minister

reported that in the supersession of the Municipal Solid Waste (Management and Handling) Rules, 2000, the Government has notified that no waste generator shall dispose-off waste to drains or in water bodies (XVII-5537).

In the 13th LS, 5 questions (out of 17) concerned the revival of the mythological Saraswati River (XVI-1030). A member asked, 'whether Indian Geologists are engaged in the job of discovering the river Saraswati' to which the Minister responded in affirmation (XIII-456). Others queried plans 'to undertake digging of the entire course of the extinct Saraswati river' (XIII-184), the progress made in this regard (XIII-4284) and 'whether the Government has formulated any scheme for re-generation of the said river', which was addressed to the Minister of Culture (XVII-4668).

3.4. Utilization of water within the basin and organizations/authorities

Questions concerning the current state of utilization of water within the basin ($n = 239$) can be broadly categorized into (a) water for food, energy and recreation ($n = 151$) and (b) large volume water management within the basin pertaining to institutional matters ($n = 88$). Many questions ($n = 58$) were raised regarding the availability of water in the rivers and the state of its utilization in the first decade ($n = 25$ and 19 in the 13th and 14th LS, respectively) but decreased considerably in the 16th LS as questions concerning interlinking of rivers (presented in Section 3.1) increased. Attention towards dams and barrages ($n = 55$) has decreased ($n = 18$ in the 13th LS while $n = 11$ each in the 14th, 15th and 16th LS) while questions regarding hydropower generation remained constant. Questions regarding the development of rivers for tourism purposes ($n = 16$) increased in the 16th LS ($n = 7$) compared to the previous tenures ($n = 2$ and 3) but for agriculture (other than irrigation projects in general) ($n = 2$) and fishery ($n = 1$) were minimal.

General queries pertaining to river development (including multipurpose) projects have remained constant, but questions regarding River Basin Organizations/Authorities increased in the 15th and 16th LS ($n = 16$ and 12, respectively). Two pertinent questions (XIII*285 and XIII-975) regarding RBOs, in general, were asked during the 13th LS, which provide important evidence for the evolution of the River Basins Organizations/Authorities in the country. The first Question (XIII*285) asked if 'the Government have given some statutory powers to the River Board Organizations in the management of water resources; and whether some State Governments have opposed this decision of the Government.' The Minister (of Water Resources) responded that the River Boards Act 1956 have provisions for the establishment of RBOs, with the advisory role in consultation with the concerned State Governments, but no River Basin Organization has been set up under this Act so far. The Minister added that Brahmaputra Board, Betwa River Board and Damodar Valley Corporation were set up under different acts of Parliament, while the Bhakra Beas Management Board and Tungabhadra Board were set up under State Reorganization Acts and Narmada Control Authority under the Inter-State Water Disputes Act 1956. The other question (XIII-975) asked if the Government proposes 'to hold regular meetings with all the State Governments with a view to impress upon the States the need for the establishment of River Basin Organizations (RBOs) and, whether any blue-print on the subject proposed ... by the Government.' To this, the Minister responded that 'a committee has been constituted with eight State Governments and three meetings of the Committee have been held so far' adding that 'The recommendations of the Committee on the model structure for River Basin Organizations have to be considered by the National Water Board of which Chief Secretaries of all the States/Union Territories are members.'

All 16 questions in the 15th LS pertain to the Ganga River Basin Authority and Yamuna River Development Authority (a major tributary of the Ganga) except one (XV-417) pertaining to the Cauvery River Authority. Questions concerning the Ganga Basin Authority ($n = 8$) continued to dominate in the 16th LS with only one Question each concerning Cauvery, Brahmaputra and Krishna.

3.5. Mitigation of disasters caused by rivers

Questions regarding disasters caused by rivers and actions to mitigate them make up about 8% ($n = 143$) of the total questions on rivers. Questions focused on addressing erosion caused by rivers ($n = 65$) and siltation and dredging ($n = 51$) to reduce flood disasters. Many proposals for desilting and widening of riverbeds to increase conveyance capacity were also proposed through the questions. A member speculated (XIII-1029) that ‘the storage capacity of the rivers in the country has been going down as their deepening work is not being undertaken [by the Government] for the last so many years.’ The follow-up question asked if the Government had assessed the storage capacity of rivers to which the Minister denied. Others asked if the siltation of rivers is affecting agriculture (XIII-5106) and if the Government proposes to formulate a National Scheme to dredge all major rivers in the country (XIII-2256) to which the Minister denied having such information. Queries regarding the extent of siltation and the need for dredging continued to be raised in the 16th LS to which the Minister clarified that desilting, in general, was not technically feasible nor cost-effective due to non-sustainability and the lack of land for the disposal of dredged material etc. To another query (XVI-1107), the Minister clarified that desiltation has no direct role in improving environment flow in the river. Other questions concerned the susceptibility of important infrastructures such as railway stations (XIV-3088), temples (XIII-2010), river islands, the effects of the changing courses of rivers (XIII-1858) and rehabilitation of people affected (XVI-583 and XVI-2208) due to erosion and floods.

4. DISCUSSION

The analysis of the PQs provides a multidimensional picture of the evolving priorities of law-policymakers on the key issues of natural and environmental resources governance and the challenges of managing and utilizing them to support sustainable development. While the issues raised by politicians are shaped by contemporary issues, the way topical issues are addressed has long-term consequences (Bundi, 2018b). Since the law-policymakers have the mandate to make laws and policies, analysing the key issues identified and recorded by them enables the scientific community to understand the perspectives and understandings of the former. In corollary, it provides critical insights into how science is making an impact in the processes of resources governance. Four key insights from this study with potential global relevance are discussed.

4.1. Evolving societal values and priorities of environmental conservations gets reflected in the PQs

Three key observations can be drawn on the evolution of societal values and priorities from the changing trends of the PQs. First, the increasing attention of the law-policymakers to the governance of river issues is indicated by the increasing number of PQs concerning rivers in absolute and percentage terms over the last two decades (Table 1). This change mirrors wider global concerns, initiatives and increasing awareness of the ecosystem services and natural capital of rivers; of water as a key constraint on economic development; and the need to protect the environment expressed through the United Nations’ Sustainable Development Goals and other international cooperation. But the increased questions on river pollution were also due to the launching of three programmes by the Government: (a) National River Conservation Plan, (b) Jawaharlal Nehru National Urban Renewal Mission and (c) AMRUT which included funding of sewerage treatment plans. Second, there is an associated increasing recognition since the 16th LS, 2014, of the cultural and religious importance of rivers in India, which is not confined to the Ganga. That this cultural and religious importance is particularly important to, but not confined to, India demonstrates an increasing politicization of religious and cultural sentiments (Mawdsley, 2005; de Micheaux, 2019; Batabyal & Beladi, 2020). The attention paid by law-policymakers to the river Ganges/Ganga (Batabyal & Beladi, 2020) is

particularly due to the large population along the river (see the map of India indicating population density, number of MPs and major rivers in Figure 3) and hence its importance in electoral politics (Singh & Singh, 2020).

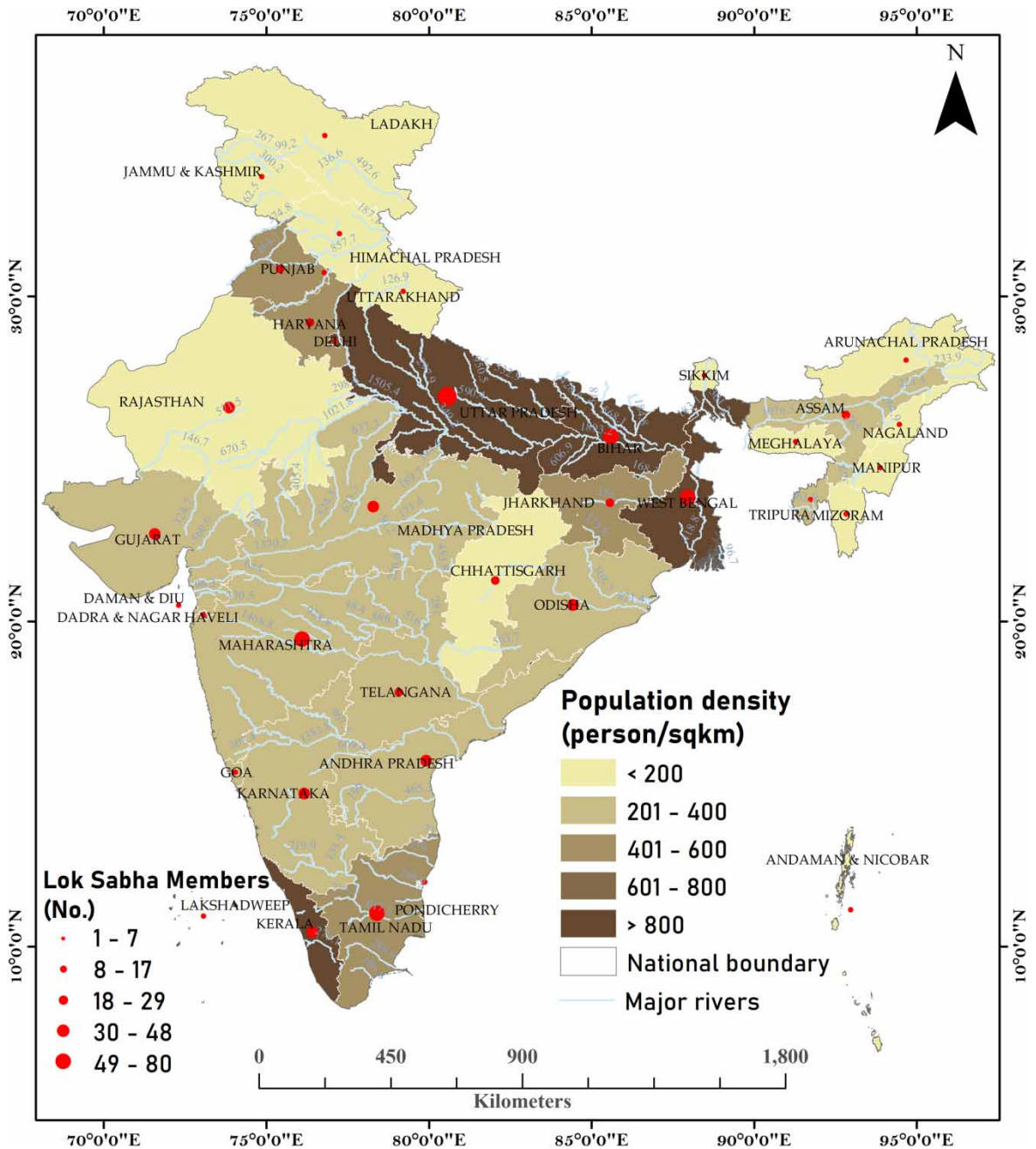


Fig. 3 | The map of India indicating major rivers, population density and number of Lok Sabha members in each state.

Third, a shift in values is apparently away from the prioritization of economic development to an awareness that development should not be at the expense of future generations. This could be viewed as a transition from viewing sustainability as primarily economic and agricultural sustainability towards a more balanced social–economic–environmental perspective. The increasing attention being paid to river pollution and rivers rejuvenation programmes in PQs, particularly evident in the second decade (15th LS), reflects the growing environmental and sustainable development concerns worldwide (Aznar-Sánchez *et al.*, 2019), indicating that the evolving societal values and priorities are reflected in the PQs.

4.2. Focus shifting from resource provisions to a holistic view of water management although debates on resource sharing persist.

Debates have also shifted from dams as a solution to droughts and floods to the interlinking of rivers and pollution abatement in the last two decades. This reflects the politicization of the interlinking of rivers as a panacea for water security in India – both for and against the agenda – and the growing concern regarding water-use constraints due to river pollution (Hazarika & Kalita, 2020). According to Central Water Commission (2019), while 2,626 dams were constructed between 1971 and 1990, only 1,400 were constructed (with 411 under construction) since 1990.

The increases in PQs regarding river pollution in India since the 15th LS are intricately linked to the religious importance of rivers, such that religious activities (such as immersion of idols or cremation on riverbanks) are often cited as the cause of pollution, while the need to clean up rivers is also justified attributing the sacredness of rivers. The idea of treating rivers as ‘living entities’ and thus owning inherent rights had been highly contentious (Clark *et al.*, 2019b), partly because a large volume of untreated sewage continues to be disposed into rivers. Further debates concerning riverfront development (Mell, 2018; Pessina, 2018; Mahadevia & Lathia, 2019; Bedarkar & Mishra, 2021) for (often religious) tourism add to the complexities. Consequently, more PQs were addressed to the Ministries of Culture, Tourism and Urban Development (renamed as Housing and Urban Affairs since the 16th LS) than to the Ministry of Power, despite considerable debates regarding hydropower projects (Erlewein & Nüsser, 2011; Erlewein, 2013; Hussain *et al.*, 2019; Sahukhal & Bajracharya, 2019).

The debate concerning the interlinking of rivers is likely to continue, at least in the realm of electoral politics. While concerns have been raised regarding economic and technological viability (Jain *et al.*, 2008; Shah & Amarasinghe, 2016) and environmental sustainability (Verdhen, 2016; Higgins *et al.*, 2018), keeping the debate alive in the public memory has political dividends (Bozorg-Haddad *et al.*, 2020) as it can be used as an electoral agenda (Schiff, 2014; Batabyal & Beladi, 2020), both for and against the linking of rivers depending on who benefits from such mega projects.

4.3. Science and perspectives of law-policymakers

Parliaments depute scientific committees to advise governments on specific matters (Bundi, 2018a), but how scientific publications shape the perspectives of law-policymakers is difficult to measure (Sundqvist *et al.*, 2015). The PQs show that the influence of scientific research on the attention of the law-policymakers is limited to politically- or culturally-sensitive topics, such as the impacts of sacred wastes on river water quality (Chakrabarty, 2020). In contrast, the expected decrease in water resources in India due to global environmental changes (e.g. Mall *et al.*, 2006; Sharma & Shakya, 2006; Gosain *et al.*, 2011; Das, 2013) does not feature in PQs or within government responses to PQs (XV-903). Similarly, the government in its PQ responses has declined to study the impacts of the interlinking of rivers in other countries (e.g. Gupta & van der Zaag, 2008; Sowers *et al.*, 2011; Guo *et al.*, 2021) or to study the hydrologic response of river systems to river channelization,

flood control and river management for stream bank erosion (e.g., XV-2591). These omissions suggest reluctance on the part of the Government to take a science-based approach to assess the consequences of its 'development' schemes.

Whilst scientific research outputs appear to have little influence on law-policymakers, there is some evidence that political interests may influence research. PQs regarding pollutants in the Brahmaputra River were followed by multiple studies (e.g., Hazarika & Kalita, 2020; Singh *et al.*, 2020) that were not commissioned by the Government. However, understanding how science shapes public policy is a research question that requires evaluating the local contextual circumstances under which policies and laws are framed.

4.4. Water governance and political priorities

Although PQs are presented in a non-political manner, the political ideologies underlying them are evident. The interlinking and 'nationalization' of rivers and a transition to the river basin as the basis of water governance are significant political issues. The 'nationalization' of rivers would give the Federal Government greater control and would benefit the water-scarce states such as Gujarat, Maharashtra and Tamil Nadu. The debate concerning the 'nationalization' of rivers (making the governance of rivers a Central Government prerogative) impinges on the rights and powers of the State Governments because water governance is in the State list of the Indian constitution. While there are proponents to shift water from the State list to the concurrent list (with both the Central Government and State Governments having the power to make laws for water governance), many (relatively water-rich) states are uncomfortable with the Central/Federal Government having greater control over their rivers. In a related issue, river basins, rather than State political boundaries, as the basis of water governance are increasingly being advocated as a better approach to efficient water management in India by many Government officials who will impinge on India's federalism (Iyer, 1994). The *draft River Basin Management Bill (2018)* proposes to define 'Basin State' as 'a State or Union Territory, the territory of which includes any portion of an inter-State River or is a beneficiary of waters from the basin' (p.9), thereby classifying beneficiary states which receive water through the interlinking of rivers as 'Basin States' and hence a key stakeholder triggering other governance complications. While the 30 proposed river interlinking schemes are projected as promoting national integration and a fair and equitable sharing of the country's water wealth, others opine that it will generate greater disputes, governance complications and environmental impacts (Agoramoorthy, 2014). The trends in the PQs (Table 1) and politicization of the issue suggest debates concerning the interlinking of rivers or inter-basin water transfer will be a continuing perennial debate.

Why MPs asked certain questions while leaving out other potentially more important or urgent issues is a matter of subjective debate (Varone *et al.*, 2020). Earlier reports (e.g., Doig, 1998) indicated that sometimes MPs have been influenced by certain interest groups (Varone *et al.*, 2020) and use the resultant findings to shape public policy. Kumar (2017) highlighted the role of the 'academic-bureaucrat-politician nexus' in shaping not only the political discourse on water management in India but also the growing influence of civil society groups. Strategies used by interest groups to lobby the elected members and influence the policymaking process through consultation procedures and parliamentary hearings are well studied (Varone *et al.*, 2020). However, how social participation shapes the choice of questions raised by the MPs and how do the latter utilize the privilege of PQs to bring the concerns of their respective constituencies to the attention of the executive (or whether party ideologies prevail over specific concerns of the citizens) are questions that must be explored in other political studies.

5. CONCLUSION

The governance of common pool environmental resources requires understanding the rich and multidimensional interaction between science, policy and societal values. While rationalists might prefer that the governance of

natural and common pool resources, such as rivers, be dictated by scientific assessments alone, societal values and political priorities often play a primary role in decision-making. Evaluating the PQs raised in the Indian Parliament in the last two decades reveals important insights into evolving priorities and issues from the perspective of law-policymakers.

An analysis of key themes within the PQs shows that the increasing awareness of the environmental impacts of human interventions on the riverine ecosystem is increasingly being recognized in the parliamentary discourses, reflecting the role of persuasion in public policy. Consequently, perspectives on river management are transitioning away from prioritizing economic and agricultural development (that has led to significant environmental degradation) and the focus on large dams for energy and water security towards a more balanced social–economic–environmental perspective to regulating human impacts on the river which recognizes the importance of environmental flows, pollution abatement and river restoration to the delivery of multiple ecosystem services and water security.

However, the analysis shows that Parliamentarians use the privilege of PQs to press their specific agenda so that this transition is also influenced by the politicization of multiple aspects of river management, including the relative role of the Federal Government and States; religious practices and religious perceptions of rivers, including the Ganga; and the large-scale interlinking of rivers and the associated political boundaries for water governance. Consequently, the research suggests that there can be a potential electoral benefit in keeping contentious issues active in the public and political debate. Therefore, the analysis also sheds light on other inter-related interdisciplinary research, such as Political Science, Conflict Resolutions and Development Studies, which goes beyond the scope of this paper. Other key research gaps to be explored by interdisciplinary studies include the role of media and publication of scientific reports in influencing and prompting parliamentarians to raise particular questions, and thereby, presumably, bringing the attention of the Executive to particular issues.

Our analysis demonstrates that the evolving societal values, priorities and political pressures represented in PQs suggest the need for increased interactions between law-policymakers and academic researchers in governing common pool environmental resources such as rivers, particularly in the context of the ecological and societal impacts of large-scale inter-basin water transfer. The analysis provides evidence for the need for more assessments of multiple riverine service interactions with better inclusion of powerful stakeholders such as the law-policymakers. Addressing these challenges will help riverine ecosystem service science inform river management and increase the potential for the ecosystem service concept to inform common pool environmental resources governance and decision-making processes. Our quantitative and qualitative analysis of PQs uncovers several remaining interdisciplinary research gaps, impeding the governance of the riverine ecosystems for sustainable development and provides rich insights into two-way cross-fertilization between law-policymakers and researchers. The research has shown how drawing out key issues of river governance from the PQs and exploring how the priorities of lawmakers have changed over the last two decades, and what it reveals about their current priorities, provides important insights into large and democratically elected governments, particularly in developing economies mired in conflicting priorities over resources distribution, economic developmental priorities, pollution abatement and conflicting societal values.

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DATA AVAILABILITY STATEMENT

The data underlying this study are openly available in the web archive of the Parliament of India, Lok Sabha at <http://164.100.47.194/Loksabha/Questions/Qtextsearch.aspx>.

CONFLICT OF INTEREST

The authors declare there is no conflict.

REFERENCES

- Agoramoorthy, G. (2014). India's river linking project: will it benefit or backfire? *Current Science* 107(6), 951. <https://doi.org/10.18520/cs/v107/i6/951-951>.
- Aznar-Sánchez, J. A., Velasco-Muñoz, J. F., Belmonte-Ureña, L. J. & Manzano-Agugliaro, F. (2019). The worldwide research trends on water ecosystem services. *Ecological Indicators* 99(December 2018), 310–323. <https://doi.org/10.1016/j.ecolind.2018.12.045>.
- Bailer, S. (2011). People's voice or information pool? The role of, and reasons for, parliamentary questions in the Swiss parliament. *Journal of Legislative Studies* 17(3). <https://doi.org/10.1080/13572334.2011.595123>
- Basco-Carrera, L., Meijers, E., Sarisoy, H. D., Şanlı, N. O., Coşkun, S., Oliemans, W., van Beek, E., Karaaslan, Y. & Jonoski, A. (2018). An adapted companion modelling approach for enhancing multi-stakeholder cooperation in complex river basins. *International Journal of Sustainable Development and World Ecology* 25(8), 1–18. <https://doi.org/10.1080/13504509.2018.1445668>.
- Batabyal, A. A. & Beladi, H. (2020). A political economy model of the Ganges pollution cleanup problem. *Natural Resource Modeling* 33(4). <https://doi.org/10.1111/nrm.12285>.
- Bedarkar, M. & Mishra, M. (2021). Riverfront development of Mula-Mutha: exploring alternatives to the Sabarmati model. *Economic and Political Weekly* 56(2), 21–24.
- Best, J. (2019). Anthropogenic stresses on the world's big rivers. *Nature Geoscience* 12(1), 7–21. <https://doi.org/10.1038/s41561-018-0262-x>.
- Bevir, M. (2012). *Governance: A Very Short Introduction*. Oxford University Press, Oxford, p. 132. ISBN 978 0 19 960641 2.
- Bozorg-Haddad, O., Abutalebi, M., Chu, X. & Loáiciga, H. A. (2020). Assessment of potential of intraregional conflicts by developing a transferability index for inter-basin water transfers, and their impacts on the water resources. *Environmental Monitoring and Assessment* 192(1). <https://doi.org/10.1007/s10661-019-8011-1>.
- Bryant, A., (2014). The grounded theory method. In: *The Oxford Handbook of Qualitative Research*. Leavy, P. (ed.). Oxford University Press, Oxford, pp. 116–136.
- Bundi, P. (2018a). Parliamentarians' strategies for policy evaluations. *Evaluation and Program Planning* 69, 130–138. <https://doi.org/10.1016/j.evalprogplan.2017.02.003>.
- Bundi, P. (2018b). Varieties of accountability: how attributes of policy fields shape parliamentary oversight. *Governance* 31(1), 163–183. <https://doi.org/10.1111/gove.12282>.
- Castonguay, S., (2017). Rivers, industrial cities, and hinterland production in Quebec in the nineteenth and twentieth centuries. In *Rivers Lost, Rivers Regained*. Knoll, M., Lübken, U. & Schott, D., (eds). University of Pittsburgh Press, pp. 25–45. <https://doi.org/10.2307/j.ctt1qnw8gv.5>.
- Central Water Commission (2019). *National Register of Large Dams*. Available at: <http://cwc.gov.in/sites/default/files/nrld06042019.pdf>
- Chakrabarty, S. (2020). Factors leading to disposal of toxic and hazardous sacred waste and its effect on urban river contamination: case of Adi Ganga, Kolkata, India. In *Springer Geography*. https://doi.org/10.1007/978-3-030-25879-5_11.
- Chakraborty, A. (2013). Developing rivers: how strong state and bureaucracy continue to suffocate environment-oriented river governance in Japan. *SAGE Open* 3(4), 2–4. <https://doi.org/10.1177/2158244013501329>.
- Ching, L. & Mukherjee, M. (2015). Managing the socio-ecology of very large rivers: collective choice rules in IWRM narratives. *Global Environmental Change* 34, 172–184. <https://doi.org/10.1016/j.gloenvcha.2015.06.012>.
- Clark, C., Emmanouil, N., Page, J. & Pelizzon, A. (2019a). Can you hear the rivers sing? Legal personhood, ontology, and the nitty-gritty of governance. *Ecology Law Quarterly* 45(4), 787–844. <https://doi.org/10.15779/Z388S4JP7M>.

- Clark, C., Emmanouil, N., Page, J. & Pelizzon, A. (2019b). Can you hear the rivers sing? Legal personhood, ontology, and the nitty-gritty of governance. *Ecology Law Quarterly* 45(4), 787–844. <https://doi.org/10.15779/Z388S4JP7M>.
- Das, a. (2013). 'Mapping the regional variation in potential vulnerability in Indian agriculture to climate change' - an exercise through constructing vulnerability index. *African Journal of Environmental Science and Technology* 7(4), 112–121. <https://doi.org/10.5897/AJEST10.288>.
- de Micheaux, F. L. (2019). Politicizations of a sacred river: the story of Gaumukh-Uttarkashi eco-sensitive zone, Uttarakhand, India. *Journal for the Study of Religion, Nature and Culture* 13(2), 181–207. <https://doi.org/10.1558/jsrc.36737>.
- Doig, A. (1998). 'Cash for questions': parliament's response to the offence that dare not speak its name. *Parliamentary Affairs* 51(1), 36–50. <https://doi.org/10.1093/oxfordjournals.pa.a028774>.
- Driessen, P. P. J., Dieperink, C., van Laerhoven, F., Runhaar, H. A. C. & Vermeulen, W. J. V. (2012). Towards a conceptual framework for the study of shifts in modes of environmental governance – experiences from The Netherlands. *Environmental Policy and Governance* 22(3), 143–160. <https://doi.org/10.1002/eet.1580>.
- Erlewein, A. (2013). Disappearing rivers – the limits of environmental assessment for hydropower in India. *Environmental Impact Assessment Review* 43, 135–143. <https://doi.org/10.1016/j.eiar.2013.07.002>.
- Erlewein, A. & Nüsser, M. (2011). Offsetting greenhouse gas emissions in the Himalaya? Clean development dams in Himachal Pradesh, India. *Mountain Research and Development* 31(4), 293–304. <https://doi.org/10.1659/MRD-JOURNAL-D-11-00054.1>.
- Fereday, J. & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis : a hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods* 5(March), 80–92. <https://doi.org/10.1063/1.2011295>.
- Gosain, A. K., Rao, S. & Arora, A. (2011). Climate change impact assessment of water resources of India. *Current Science* 101(3), 356–371.
- Grabowski, R. C., Vercruyse, K., Holman, I., Azhoni, A., Bala, B., Shankar, V., Beale, J., Mukate, S., Poddar, A., Peng, J. & Meersmans, J. (2022). The land–river interface: a conceptual framework of environmental process interactions to support sustainable development. *Sustainability Science*. <https://doi.org/10.1007/s11625-022-01150-x>.
- Graneheim, U. H. & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today* 24(2), 105–112. <https://doi.org/10.1016/j.nedt.2003.10.001>.
- Guest, G., MacQueen, K. & Namey, E. (2012). *Applied Thematic Analysis*. SAGE Publications. <https://doi.org/10.4135/9781483384436>.
- Guo, S., Xiong, L., Zha, X., Zeng, L. & Cheng, L. (2021). Impacts of the Three Gorges Dam on the streamflow fluctuations in the downstream region. *Journal of Hydrology* 598(February), 126480. <https://doi.org/10.1016/j.jhydrol.2021.126480>.
- Gupta, J. & van der Zaag, P. (2008). Interbasin water transfers and integrated water resources management: where engineering, science and politics interlock. *Physics and Chemistry of the Earth* 33(1–2), 28–40. <https://doi.org/10.1016/j.pce.2007.04.003>.
- Haidvogel, G., (2018). *Historic milestones of human river uses and ecological impacts BT*. In *Riverine Ecosystem Management: Science for Governing Towards A Sustainable Future*. Schmutz, S. & Sendzimir, J., (eds). Springer International Publishing, pp. 19–39. https://doi.org/10.1007/978-3-319-73250-3_2.
- Hazarika, A. K. & Kalita, U. (2020). Incidence of heavy metals and river restoration assessment of a major South Asian transboundary river. *Environmental Science and Pollution Research* 27(25), 31595–31614. <https://doi.org/10.1007/s11356-020-09328-5>.
- Higgins, S. A., Overeem, I., Rogers, K. G. & Kalina, E. A. (2018). River linking in India: downstream impacts on water discharge and suspended sediment transport to deltas. *Elementa* 6. <https://doi.org/10.1525/elementa.269>.
- Huber, A. & Joshi, D. (2015). Hydropower, anti-politics, and the opening of new political spaces in the Eastern Himalayas. *World Development* 76(289374), 13–25. <https://doi.org/10.1016/j.worlddev.2015.06.006>.
- Hudson-Rodd, N. & Shaw, B. J. (2003). Mekong river development: whose dreams? Which visions? *Water International* 28(2), 268–275. <https://doi.org/10.1080/02508060308691692>.
- Hussain, A., Sarangi, G. K., Pandit, A., Ishaq, S., Mamnun, N., Ahmad, B. & Jamil, M. K. (2019). Hydropower development in the Hindu Kush Himalayan region: issues, policies and opportunities. *Renewable and Sustainable Energy Reviews* 107(March), 446–461. <https://doi.org/10.1016/j.rser.2019.03.010>.
- Iyer, R. R. (1994). Indian federalism and water resources. *International Journal of Water* 10(2), 191–202. <https://doi.org/10.1080/07900620120094055>.

- Jain, S. K., Kumar, V. & Panigrahy, N. (2008). Some issues on interlinking of rivers in India. *Current Science* 95(6), 728–735.
- Kumar, M. D. (2017). *Water management in India: the multiplicity of views and solutions*. *International Journal of Water Resources Development* 34(1), 1–15. <https://doi.org/10.1080/07900627.2017.1351333>.
- Legendijk, V. (2019). *Streams of knowledge: river development knowledge and the TVA on the river Mekong*. *History and Technology* 35(3), 316–337. <https://doi.org/10.1080/07341512.2019.1680156>.
- Li, W. J., Yu, S. Y., Pan, J., Cao, X., Chen, Y. & Wang, Y. (2021). *A 2000-year documentary record of Levee breaches on the lower Yellow River and their relationship with climate changes and human activities*. *Holocene* 31(3), 333–345. <https://doi.org/10.1177/0959683620972764>.
- Lok Sabha (n.d.). *Introduction to Parliamentary Questions*. Lok Sabha, House of People, Parliament of India. Available at: <http://loksabhaph.nic.in/Questions/QuestionsHome.aspx> (accessed 7 July 2021).
- Macklin, M. G. & Lewin, J. (2015). The rivers of civilization. *Quaternary Science Reviews* 114, 228–244. <https://doi.org/10.1016/j.quascirev.2015.02.004>.
- Mahadevia, D. & Lathia, S. (2019). *Women’s safety and public spaces: lessons from the Sabarmati riverfront*. *India. Urban Planning* 4(2), 154–168. <https://doi.org/10.17645/up.v4i2.2049>.
- Mall, R. K., Gupta, A., Singh, R., Singh, R. S. & Rathore, L. S. (2006). *Water resources and climate change: an Indian perspective*. *Current Science* 90(12), 1610–1626. [https://doi.org/10.1016/S0143-8166\(02\)00004-0](https://doi.org/10.1016/S0143-8166(02)00004-0).
- Martin, S. (2011). *Using parliamentary questions to measure constituency focus: an application to the Irish case*. *Political Studies* 59(2), 472–488. <https://doi.org/10.1111/j.1467-9248.2011.00885.x>.
- Martin, S. & Rozenberg, O. (2014). *The Roles and Function of Parliamentary Questions*. Routledge, London. <https://doi.org/10.4324/9780203722695>
- Mawdsley, E. (2005). *The abuse of religion and ecology: the Vishva Hindu Parishad and Tehri Dam*. *Worldviews: Environment, Culture, Religion* 9(1), 1–24. <https://doi.org/10.1163/1568535053628427>.
- Mell, I. C. (2018). *Greening Ahmedabad – creating a resilient Indian city using a green infrastructure approach to investment*. *Landscape Research* 43(3), 289–314. <https://doi.org/10.1080/01426397.2017.1314452>.
- Moench, M. (2010). *Responding to climate and other change processes in complex contexts: challenges facing development of adaptive policy frameworks in the Ganga Basin*. *Technological Forecasting and Social Change* 77(6), 975–986. <https://doi.org/10.1016/j.techfore.2009.11.006>.
- Mourao, P. R. (2019). *The effectiveness of green voices in parliaments: do green parties matter in the control of pollution?* *Environment, Development and Sustainability* 21(2), 985–1011. <https://doi.org/10.1007/s10668-017-0070-2>.
- Pessina, G. (2018). *The ‘missing conflict’ of the Sabarmati Riverfront: authoritarian governance, neoliberalism and water in Ahmedabad, India*. *Partecipazione e Conflitto* 11(3), 692–716. <https://doi.org/10.1285/i20356609v11i3p692>.
- Press, O. U. (1996). *The key informant technique*. *Family Practice* 13(1), 92–97.
- Quintana-Ashwell, N., Gholson, D., Kaur, G., Singh, G., Massey, J., Krutz, L. J., Henry, C. G., Cooke III, T., Reba, M. & Locke, M. A. (2022). *Irrigation water management tools and alternative irrigation sources trends and perceptions by farmers from the delta regions of the lower Mississippi River basin in South Central USA*. *Agronomy* 12 (4), 894. doi:10.3390/agronomy12040894.
- QSR International Pty Ltd (2018). *NVivo (Version 12)*. Available at: <https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home>
- Sahukhal, R. & Bajracharya, T. R. (2019). *Modeling water resources under competing demands for sustainable development: a case study of Kaligandaki Gorge Hydropower Project in Nepal*. *Water Science and Engineering* 12(1), 19–26. <https://doi.org/10.1016/j.wse.2019.03.002>.
- Saldana, J. (2009). *The coding manual for qualitative researchers*. In *The Coding Manual for Qualitative Researchers*. <https://doi.org/10.1109/TEST.2002.1041893>
- Schiff, J. S. (2014). *Silencing the opposition: the State v. Civil Society in India’s Ganges River Basin*. *International Studies Perspectives* 15(2), 229–242. <https://doi.org/10.1111/insp.12039>.
- Schoenefeld, J. J. & Jordan, A. J. (2019). *Environmental policy evaluation in the EU: between learning, accountability, and political opportunities?* *Environmental Politics* 28(2), 365–384. <https://doi.org/10.1080/09644016.2019.1549782>.
- Shah, T. & Amarasinghe, U. A. (2016). *River linking project: a solution or problem to India’s water woes?* In *Global Issues in Water Policy*, Vol. 16. https://doi.org/10.1007/978-3-319-25184-4_7.
- Sharma, R. H. & Shakya, N. M. (2006). *Hydrological changes and its impact on water resources of Bagmati watershed, Nepal*. *Journal of Hydrology* 327(3–4), 315–322. <https://doi.org/10.1016/j.jhydrol.2005.11.051>.

- Sharma, A., Karki, E., Eriyagama, N., Shrestha, G., Jeuland, M. & Bharati, L. (2020). Whose river is it? An assessment of livelihood and cultural water flow requirements for the Karnali basin. *Ecology and Society* 25(3), 1. <https://doi.org/10.5751/es-11763-250322>.
- Singh, R. & Singh, G. S. (2020). Integrated management of the Ganga River: an ecohydrological approach. *Ecohydrology and Hydrobiology* 20(2), 153–174. <https://doi.org/10.1016/j.ecohyd.2019.10.007>.
- Singh, K. R., Goswami, A. P., Kalamdhad, A. S. & Kumar, B. (2020). Surface water quality and health risk assessment of Kameng River (Assam, India). *Water Practice and Technology* 15(4), 1190–1201. <https://doi.org/10.2166/wpt.2020.090>.
- Sowers, J., Vengosh, A. & Weinthal, E. (2011). Climate change, water resources, and the politics of adaptation in the Middle East and North Africa. *Climatic Change* 104(3–4), 599–627. <https://doi.org/10.1007/s10584-010-9835-4>.
- Strijbos, J. W., Martens, R. L., Prins, F. J. & Jochems, W. M. G. (2006). Content analysis: what are they talking about? *Computers and Education* 46(1), 29–48. <https://doi.org/10.1016/j.compedu.2005.04.002>.
- Sullivan, A., White, D. D. & Hanemann, M. (2019). Designing collaborative governance: insights from the drought contingency planning process for the lower Colorado River basin. *Environmental Science and Policy* 91, 39–49. <https://doi.org/10.1016/j.envsci.2018.10.011>.
- Sundqvist, G., Bohlin, I., Hermansen, E. A. T. & Yearley, S. (2015). Formalization and separation: a systematic basis for interpreting approaches to summarizing science for climate policy. *Social Studies of Science* 45(3), 416–440. <https://doi.org/10.1177/0306312715583737>.
- Tang, Z., Dai, Z., Fu, X. & Li, X. (2013). Content analysis for the U.S. coastal states' climate action plans in managing the risks of extreme climate events and disasters. *Ocean and Coastal Management* 80, 46–54. <https://doi.org/10.1016/j.ocecoaman.2013.04.004>.
- Uprety, K. & Salman, S. M. A. (2011). Legal aspects of sharing and management of transboundary waters in South Asia: preventing conflicts and promoting cooperation. *Hydrological Sciences Journal* 56(4), 641–661. <https://doi.org/10.1080/02626667.2011.576252>.
- Vandenbergh, J. (1995). Timescales, climate and river development. *Quaternary Science Reviews* 14(6), 631–638. [https://doi.org/10.1016/0277-3791\(95\)00043-O](https://doi.org/10.1016/0277-3791(95)00043-O).
- Varone, F., Bundi, P. & Gava, R. (2020). Policy evaluation in parliament: interest groups as catalysts. *International Review of Administrative Sciences* 86(1), 98–114. <https://doi.org/10.1177/0020852317750461>.
- Vercruyse, K., Grabowski, R. C., Holman, I., Azhoni, A., Bala, B., Meersmans, J., Peng, J., Shankar, V., Mukate, S., Poddar, A., Wang, X. & Zhang, Z. (2022). Placed-based interpretation of the sustainable development goals for the land-river interface. *Sustainability Science*. <https://doi.org/10.1007/s11625-022-01176-1>.
- Verdhen, A. (2016). Intra and inter basin linking of rivers in water resources management. *Journal of Scientific and Industrial Research* 75(3), 150–155.
- Vinca, A., Parkinson, S., Byers, E., Burek, P., Khan, Z., Krey, V., Diuana, F. A., Wang, Y., Ilyas, A., Köberle, A. C., Staffell, I., Pfenninger, S., Muhammad, A., Rowe, A., Schaeffer, R., Rao, N. D., Wada, Y., Djilali, N. & Riahi, K. (2020). The NEXUS Solutions Tool (NEST) v1.0: an open platform for optimizing multi-scale energy-water-land system transformations. *Geoscientific Model Development* 13(3), 1095–1121. <https://doi.org/10.5194/gmd-13-1095-2020>.
- Voinov, A., Jenni, K., Gray, S., Kolagani, N., Glynn, P. D., Bommel, P., Prell, C., Zellner, M., Paolisso, M., Jordan, R., Sterling, E., Schmitt Olabisi, L., Giabbanelli, P. J., Sun, Z., Le Page, C., Elsawah, S., BenDor, T. K., Hubacek, K., Laursen, B. K., Jetter, A., Basco-Carrera, L., Singer, A., Young, L., Brunacini, J. & Smajgl, A. (2018). Tools and methods in participatory modeling: selecting the right tool for the job. *Environmental Modelling and Software* 109(April), 232–255. <https://doi.org/10.1016/j.envsoft.2018.08.028>.
- Voorst, S. & Zwaan, P. (2019). The (non)-use of ex post legislative evaluations by the European Commission. *Journal of European Public Policy* 26(3), 366–385. <https://doi.org/10.1080/13501763.2018.1449235>.
- Wenger, E., McDermott, R. & Snyder, W. M. (2002). *Cultivating Communities of Practice: A Guide to Managing Knowledge*. Harvard Business School Press, Boston.
- Wirsing, R. G. & Jaspardo, C. (2007). River rivalry: water disputes, resource insecurity and diplomatic deadlock in South Asia. *Water Policy* 9(3), 231–251. <https://doi.org/10.2166/wp.2007.014>.
- Xie, L. & Jia, S. (2016). Diplomatic water cooperation: the case of Sino-India dispute over Brahmaputra. *International Environmental Agreements: Politics, Law and Economics* 11, 1–18. <https://doi.org/10.1007/s10784-016-9339-4>.
- Yang, X., Lu, X. & Ran, L. (2016). Sustaining China's large rivers: river development policy, impacts, institutional issues and strategies for future improvement. *Geoforum* 69, 1–4. <https://doi.org/10.1016/j.geoforum.2015.11.019>.

Zheng, Y., Naylor, L. A., Waldron, S. & Oliver, D. M. (2019). Knowledge management across the environment-policy interface in China: what knowledge is exchanged, why, and how is this undertaken? *Environmental Science and Policy* 92(November 2018), 66–75. <https://doi.org/10.1016/j.envsci.2018.09.021>.

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