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Political Ecology of a sacred river: Hydrosocial cycle and govemance of the Ganges, India

Lafaye De Micheaux Flore

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Political Ecology of a sacred river: Hydrosocial cycle and governance of the Ganges, India

Thèse de doctorat

Présentée à la
Faculté des géosciences et de l'environnement,
Institut de géographie et durabilité
de l'Université de Lausanne par

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Sous la présidence de Prof. Torsten Vennemann
(Université de Lausanne)

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Political ecology of a sacred river: hydrosocial cycle and governance of the Ganges, India

Lausanne, le 13 septembre 2019

Pour le Doyen de la Faculté des géosciences et de l'environnement

Professeur Torsten Vennemann

To my loved ones, Eric, Cassio, Perle, Mondo,
and Lafaye de Micheaux - Manuguerra family members

I have been called by Ma Ganga. […] Mother Ganga is crying in wait saying that some daring son of mine must come, who will bring me out of this dirt.

Narendra Modi, Prime Minister of India, 17 May 2014, Varanasi[1]

The Ganga, especially, is the river of India, beloved of her people, round which are intertwined her racial memories, her hopes and fears, her songs of triumph, her victories and her defeats. She has been a symbol of India's age long culture and civilization, ever-changing, ever-flowing, and yet ever the same Ganga.

Jawaharlal Nehru, former Prime Minister of India, Will and Testament, 1956[2]

[1] Narendra Modi's public speech in Varanasi, 17 May, 2014. Published by BJP party (2014), accessed https://www.youtube.com/watch?v=Jdh24WAYdok. Translated by Aditya Konwar (2016), accessed https://www.youtube.com/watch?v=R4H8Hb5beB4&feature=youtu.be.

[2] Source: http://nehrumemorial.nic.in/en/component/content/article/79-nmml/196-will andtestament.html, accessed September 15, 2017.

Political ecology of a sacred river: hydrosocial cycle and governance of the Ganges, India

Flore Lafaye de Micheaux, Institute of Geography and Sustainability, University of Lausanne

SUMMARY

How do river representations and meanings shape the governance of a river? How does the materiality of a river interfere with socio-political processes? How to account for river-society multiple-layer relations? This doctoral work aims to address these questions in the context of the Ganges River in India. It investigates the meanings of the river at multiple spatial and temporal time scales. It explores some recent ecological and political redefinitions of the Ganges River performed by Indian environmental policies. The analysis mobilizes a political ecology approach with support from case studies within the Ganges' delta and at the source of the river, in the Himalayas. This qualitative research particularly draws from the political ecology of water literature on the 'hydrosocial cycle', which refers to the *internal* and *dialectical* relation between water and society.

The thesis argues for an advancement of the hydrosocial cycle framework for use in river studies. The core of the thesis is composed of three article manuscripts. The first, published in *Géo-Regards*, bridges political ecology and Berque's *mésologie* to develop a relational approach to rivers. The second, published in *Environment and Planning E*, highlights how the hegemonic land/water conceptual divide infuses governing paradigms in the lower basin of the Ganges and affects land(water)scapes and people. It argues that hydrosocial analyses should engage further with river's materiality, here sediments, over space and time. The third, published by the *Journal for the Study of Religion, Nature and Culture*, presents how a specific ontological interpretation of the river intervened in the political debates over a protected, non-dammable zone in the source region of the Ganges.

This theoretical and empirical investigation aims to contribute in three ways to the literature. First, it furthers existing works in political ecology of rivers in

India. It highlights how the 'Ganges problem' framing evolved and gradually shifted from the need to clean a river to the need to save a landscape, a culture, spirituality and a nation. Second, it theoretically enriches the hydrosocial approach thanks to the Ganges case. The nature and roles of 'river meanings' are further defined. Third, it contributes to debates about political ecology of socio-natures, in highlighting religious and ontological dimensions on one side, and a question of material heterogeneity on the other side.

Ecologie politique d'un fleuve sacré : cycle hydrosocial et gouvernance du Gange en Inde

Flore Lafaye de Micheaux, Institut de géographie et durabilité de l'Université de Lausanne

RÉSUMÉ

Comment les représentations et les significations du fleuve façonnent-elles la gouvernance du fleuve ? Comment la matérialité du fleuve interfère-t-elle avec les processus sociopolitiques ? Comment rendre compte des multiples relations fleuve-société ? Ce travail de doctorat vise à aborder ces questions dans le contexte du Gange en Inde. Il étudie les significations du fleuve selon plusieurs échelles, aussi bien spatiales que temporelles. Il explore également certaines récentes redéfinitions écologiques et politiques du Gange, notamment au travers de politiques environnementales adoptées par le gouvernement central indien. L'analyse mobilise une approche d'écologie politique (*political ecology*) autour d'études de cas situées dans le delta du Gange, ainsi qu'à ses sources, dans l'Himalaya. Cette recherche qualitative s'appuie particulièrement sur le cadre théorique du cycle hydrosocial, qui fait référence à la relation interne et dialectique entre eau et société, au sein du courant d'écologie politique de l'eau (*political ecology of water*). La thèse plaide pour un raffinement de ce cadre d'analyse dans le contexte d'études dédiées aux fleuves.

La thèse s'articule en particulier autour de trois articles publiés ou en cours de révision. Le premier, publié dans la revue suisse *Géo-Regards* en 2016, propose de lier écologie politique et mésologie d'Augustin Berque pour développer une approche relationnelle des fleuves. Le second, publié dans le journal *Environment and Planning E* en 2018, montre comment l'opposition binaire terre / eau domine les paradigmes qui ont gouverné et gouvernent encore le bassin inférieur du Gange. L'article suggère que les analyses hydrosociales intègrent plus avant la matérialité du fleuve, ici les sédiments, dans le temps et dans l'espace. Enfin, le troisième article, publié par le *Journal for the Study of Religion, Nature and Culture*, présente comment une interprétation ontologique particulière du fleuve

est intervenue dans les débats politiques sur une zone protégée, dans la région des sources du Gange.

Cette étude théorique et empirique vise à contribuer de trois manières à la littérature. Premièrement, elle enrichit les travaux existants d'écologie politique autour des fleuves en Inde. Elle établit comment la formulation du 'problème du Gange' ne se limite plus à la nécessité de dépolluer le fleuve, mais se trouve étroitement liée à la nécessité de préserver une culture, une spiritualité et une nation. Deuxièmement, elle contribue sur le plan théorique à l'approche hydrosociale, à la lumière des travaux menés sur le Gange. La nature et le rôle des significations des fleuves dans le cycle hydrosocial sont notamment examinés et développés. Enfin, elle contribue aux débats de l'écologie politique des 'socio-natures', en mettant l'accent sur les potentialités offertes par l'étude des dimensions religieuses et ontologiques d'une part, et des questions d'hétérogénéité matérielle, d'autre part.

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CHAPTER 1 – INTRODUCTION AND RESEARCH PLAN

1.1 INTRODUCTION

The Ganges is a special river holding a powerful attraction. It is a Hindu deity, celebrated by devotees as a "Mother" whose waters purify sins. However, the Ganges River is severely polluted and artificialized. As other Indian rivers, it has been strongly affected by the rise of urbanization and industrialization, the modernization of agricultural practices and the development of river control interventions during the twentieth century. In this river basin that counts more than 400 million inhabitants, the magnitude of anthropogenic pressures on the river and their effects on the various human uses of the river are critical.

The environmental degradation of the river is a long-term and gradual phenomenon. From the early 80's onwards, the issue of the river pollution has been raised. Two Central government programmes, *Ganga Action Plan* phase 1 and phase 2 in the 80's and 90's aimed to address the pollution produced by urban wastewater. They however failed to deliver the required infrastructure and solutions. In the 2000's, new governmental actions were launched by the Congress government, such as the writing of a *Ganga River Basin Master Plan* to be undertaken by a consortium of Indian public research institutes, the Indian Institutes of Technology.

Interestingly, the representation of a 'sick' river whose health requires to be restored (or 'rejuvenated') seems to have been only recently publicized in general public spheres. Narendra Modi's government, affiliated to the Hindu Nationalist party, the BJP, enacted this move. The Prime Minister publicly took the vow on his first days of tenure in July 2014: he promised to ensure Ganges rejuvenation within five years. He also shifted the responsibility of Ganges programme from the Ministry of Environment and Forest to the Ministry of Water Resources and chose to rename the ministry with an explicit mention of the

'Ganges rejuvenation'[3]. He then publicised a new central programme, *Namami Gange*[4], comprising of multiple actions to achieve the restoration of the River.

This move is worth noticing in the context of a revered river. In 2002, in her book "On the banks of the Ganga", the anthropologist Kelly Alley showed how the representation of the Goddess Ganga that remains eternally pure and unspoiled by material filth was sustained by religious figures and priests, in Benares[5] notably. According to her analysis, this interpretation remained the dominant perspective towards the River. The Goddess and her power were considered as belonging to another realm that could not be threatened by erroneous material human actions, like the release of pollution. However, this perspective was contradicted by a public discourse from Narendra Modi in Varanasi on 17 May 2014 in which he asserted:

I have been called by Ma Ganga. […] Mother Ganga is crying in wait saying that some daring son of mine must come, who will bring me out of this dirt[6].

This new narrative thus tends to represent the River as a weakened figure who needs human support, here the Prime Minister himself, to regain her strength. This vision radically contrasts the religious perspective recorded by Kelly Alley in the early 2000's. This research thus aims to understand and clarify this political move that redefines what the River is and what it requires.

1.2 RESEARCH AGENDA

This chapter identifies the key questions that this research addresses as well as the approach and methods. At first, I introduce the overall research aims, the concepts and the existing literature that guide the research agenda.

1.2.1 Overall research aims

[3] Ministry of Water Resources, River development and Ganges rejuvenation, led by Minister Uma Bharti from 2014 to 2017.

[4] The translation of '*Namami Gange*' is 'Reverence to the Ganges'.

[5] Today the city of Varanasi.

[6] Narendra Modi's public speech in Varanasi, 17 May, 2014. Published by BJP party (2014), accessed https://www.youtube.com/watch?v=Jdh24WAYdok. Translated by Aditya Konwar (2016), accessed https://www.youtube.com/watch?v=R4H8Hb5beB4&feature=youtu.be.

This research aims to reconstitute the history of the emergence and the stabilization/transformation of a 'problem' relating to the Ganges. Following McElwee (2016), this doctoral work seeks to understand 'how [this] "environmental" problem has been identified and made visible' (2016, 16) over the last forty years. The ultimate goal of such analysis, typical of post-structural political ecology, is to critically interrogate the unquestioned dimensions of a 'constructed' environmental problem that may entail further social and environmental inequities.

This research also most centrally aims to produce theoretical contributions to the hydrosocial framework formulated within political ecology of water literature. The hydrosocial framework developed around the idea of 'water' and does not specifically address rivers. However, I wish to explore what happens when 'water' is replaced by 'river' in this framework. One obvious observation is that the latter brings in further complexity, as it is not only a water resource, but also simultaneously a localized component of the Earth's surface, a landscape, a series of interconnected ecosystems and a provider of ecosystem services. In mobilizing this framework through two case studies in contrasting sites of the Ganges River at its ends (the source and the delta), voluntarily out of the main stretch of Ganges plains such as Prayagraj-Varanasi in Uttar Pradesh[7], this doctoral work proposes to further define the nature and roles of 'river meanings' in the dialectical river-society relation that the hydrosocial cycle conceptualizes.

1.2.2 Concepts and existing literature

Post-structural political ecology or the critical investigation of environmental 'problems'

Given my focus on investigating the construction of cognitive frames in policies relating to the Ganges River, my research calls for a literature that critically considers the taken-for-granted ideas around environmental 'problems'. In this

[7] For three main reasons: first, out of time, because of the challenge raised by pursuing several detailed case studies in such diverse contexts – different State institutions, different culture and history, etc.; second, because this plain has been mostly studied in the literature and could have attracted the bulk of my research time and attention. Third, I also assumed that chosing the less known but even more contrasted areas of the delta and the source would make divergences and convergences more readable, and therefore would help the analytical work (see also in 1.3.2).

regard, post-structural political ecology offers an adequate framework. Inspired by the writings of Michel Foucault related to the close relationship between power and knowledge, and the making of 'truths' by powerful social systems and practices, this literature questions dominant truth claims related to environmental issues and explores the modalities of their construction (Forsyth, 2003; Robbins, 2012; see also Foucault, 1986, 2001, 2004). Diverse hegemonic ideas have been explored with such approaches, like the concepts of 'wilderness' by Cronon (1996), 'national parks' by Neumann (1992), 'ecosystem services' that is currently so popular in international environmental management (Kull et al., 2015) or the approach of 'river control' in India and South Asia (Baghel, 2014). The ultimate goal of such analyses – that share with the whole field of political ecology a kind of normative stance towards a more socially and environmentally just world – is to raise the contradictions that underpin the dominant environmental narratives (Forsyth, 2003) or to '[unlock] the imaginations of the public, decision-makers, planners or scientists', in order to open new possibilities in a given situation (Robbins, 2012, 70).

Socio-natures and the hydrosocial cycle

As further developed in Chapter Three, which addresses the conceptual question 'what is a river?', a river can be seen as not merely a natural object but as materially and discursively constructed by humans. My research thus draws on geographical literature that aims at capturing the theoretical consequences of such an understanding. In this regard, the 'socio-nature' concept is a useful tool. Geographer Erik Swyngedouw formed this neologism in order to draw attention on the 'missing middle' between society and nature (Castree et al., 2013; see also Swyngedouw, 1999, 2003). According to him, both entities cannot be studied in abstraction from one another. In this approach that reflects a non-dualist way of thinking, society and nature are hybrids, internally connected and co-produced. This approach moves beyond a constructivist perspective that reduces nature to a mere social construction; it also points to the agency (i.e. the capacity to act, even without intentionality) of non-human entities, drawing from Bruno Latour's work on the concept of '*actant*'.

The hydrosocial cycle concept belongs to this frame of thought. This analytical tool was developed within political ecology of water, a sub-field inspired by eco-

marxism and actor-network theory, that emerged in the 90's under the contributions of authors like Erik Swyngedouw, Karen Bakker or Maria Kaika. Like the term 'socio-nature', the hydrosocial cycle concept departs from the 'object-subject divide'. It considers water and society as iteratively co-constituting each other, in an internal and dialectical relation (Linton and Budds, 2014). The hydrosocial analysis aims to reveal how power infuses these connections. Therefore, in such approach, the hegemonic 'meanings of water' or discourses, construction, ideas or representations of water are the object of scholarly attention (Linton and Budds, 2014).

The politics of 'river meanings' and the concept of 'referential'

The hydrosocial approach belongs to a large body of literature in water research that emphasizes the political dimension of water-society relations, illustrated in many instances of irrigation or dam programmes by the proximity between hydro- and political powers. For example, a large literature on the 'Hydraulic Mission' (Wittfogel, 1957; Molle et al., 2009; Gilmartin, 1994; Swyngedouw, 2007; Baghel, 2014) showed how much, in many places of the world, state bureaucratic powers contributed to a hegemonic vision of 'river control' that reversely fuelled their prerogatives and led to irreversible river valley transformations.

Considering water as an integral component of social and political relationships, some authors propose a shift from established approaches that considers the meanings of water as projected on a material reality to an understanding of those meanings as emergent from the social and political relationships in which the material agency of water itself intervenes (Strang, 2004; Krause and Strang, 2016).

From these approaches, and drawing on the 'water meanings' proposed by Jamie Linton and Jessica Budds (2014) in the hydrosocial cycle framework (i.e. discourses, construction, ideas or representations of water), I thus propose to advance the hydrosocial analysis in river contexts by exploring the specific nature, roles and politics of 'river meanings'. I will show how this notion may prove useful in analyses.

I make here use of the term 'river meanings'[8] instead of the more common expression of 'river representations' in order to incorporate the following dimensions:

- the roles of senses, emotions and affects in the river-human relation, as well as the religious dimensions (with their in-depth relation with the meaning of human life);

- the roles of the materiality of the river;

- the processes that make the 'river meanings' both product and producer of social and political relations.

The concept of 'referential' in the field of cognitive analysis of public policy also draws on the idea of 'meaning', while targeting more specifically the genesis of public policy. As Pamela McElwee (2016) in the context of forest policy in Vietnam, Pierre Muller invites researchers to address the seemingly simple question: 'why a specific issue becomes the object of a public policy?'. He highlights that a political problem is always a complex construction to be deciphered, dependent on both the society and the political system (2013, 47). In order to study how river meanings intervened and shaped public decisions related to the Ganges River, I will then make use of the 'referential' concept that has been developed by Pierre Muller since the 90's. Pierre Muller defines the 'referential' of a public policy as a 'structure of meaning' (2013, 53) or:

[…] A referential of a policy is constituted by a group of prescriptions that gives some meaning to a political programme in defining criteria of choice and modalities of designation of objectives. It's simultaneously a cognitive process that limits the complexity of reality for a better understanding of it, and a prescriptive process that enables to act upon reality (2013, 53, my translation)

For Pierre Muller, a referential articulates four distinct ways of apprehending the world, but with obvious interrelations: values (the most fundamental representations), norms (gaps between desired and real situations), algorithms (theoretical causalities between actions and results) and images (which

[8] Though also attractive, the term 'hydro-imaginaries' coined by Samer Alatout refers to '*politico-environmental imaginaries of the river and its management*" (Alatout, 2012, p.219 citing Jasonoff, 2004). However, I prefer to use 'river meanings' as it is more directly related to the hydrosocial cycle concept, which uses the term 'water meaning'.

immediately make sense). The cognitive analysis of public policy shares several commonalities with neo-institutionalist approaches, such as the explicitation of the relation between institutions, cognitive frames and actors (Muller, 2013). However, in contrast to them, particularly naturalist ones that seek to attribute external causal explanations to institutional changes (Bouleau, 2018), the proposed field of cognitive analysis of public policy firstly emphasizes the cognitive dimension of policy; second, it stresses the importance of a close observation of the roles of the actors (Muller, 2013, 32) as it recognizes the degree of freedom of individual actors. The latter aspect will have consequences on the investigation methods (see methodological section, particularly for Chapter Six).

Governance, political ecology and rivers in India

In this doctoral work, the concept of governance is treated as a descriptive notion, and is not particularly questioned or reworked. The definition of governance that is adopted is inspired by the work of social geographer René Véron and his co-authors, whose governance definition has been phrased this way: 'governance is a network of governmental, market and societal actors, organisations and institutions that create and implement public policy' (Cornea et al., 2017). More particularly, in this thesis, the actions of 'creating' and 'implementing' public policy encompass the practices, the actions and the initiatives to *conceive* (for instance, the dialogues, consultations and negociations before the first drafts of a policy), implement and *accompany* (for instance, the contestations or the direct and indirect supports from various circles and coalitions, to the implementing actions) a public policy. Governance dynamics thus comprise actions or initiatives of whoever proactively opposes or transforms the considered public policy. This approach is in line with Foucault's later writings on governmentality, which emphasized the importance of resistance moves, of 'interlacing' and diffuse power forces as well as the continuity between the political and the non-political, in the concrete processes of government to be studied in political analyses (Crowley, 2003).

As this doctoral work investigates governance practices around the Ganges River with a political ecology perspective, this section presents a brief literature review of political ecology approaches in Indian cases. Unequal access to natural

resources, notably by marginal communities, is a theme that has been widely scrutinized in the Indian context. These approaches, which can be related to political ecology, have been mobilized since the early 80's (for example, Jodha, 1987; CSE, 1982, 1991, Gadgil and Guha, 1992; Robbins, 1998; Agrawal and Sivaramakrishnan, 2000; Agrawal, 2005; Springate-Baginski and Blaikie, 2007). In the initial studies, the issues of land and forest resources took precedence over those about water, maybe because the former were more largely impacted by uneven colonial rules and practices and their legacy. However, Indian irrigation systems and the historical features of their governance also triggered scholars' interest, from Wittfogel (1957) to Gilmartin (1994), Mosse (1999) or D'Souza (2009). Further studies in geography, environmental history or anthropology, aligned with or explicitly referring to political ecology were conducted in relation to Indian water resources. These studies often focused on resources mediated by infrastructure and technologies like canals (Mollinga, 2014; Mukherjee, 2011, 2015), dams (Mehta, 2001; Morrison, 2010; Singh, 2002), tanks (Mosse, 1999, 2006) or pumping systems (Birkenholtz, 2009, 2016). Issues of access and control, either imposed by the state and/or negotiated among communities, are prominent in this literature.

Rivers have also been studied along two dominant themes, either dealing with river control and dam issues (Baviskar, 2005; Sharma 2009; Mawdsley, 2005; Baghel, 2014; Drew, 2017), or with river pollution issues (Alley, 2000, 2002; Haberman, 2000, 2006)[9]. The main focuses of these works largely differ. However, all of these works, more or less directly, engage with river representations, whether dominantly religious (Alley, 2000, 2002; Haberman, 2000, 2006; Drew, 2017), nationalist (Sharma, 2009; Mawdsley, 2005), cultural (Baviskar, 2005; Lahiri-Dutt and Samanta, 2013; Lahiri-Dutt, 2000; 2014) or expertise-driven (Baghel, 2014).

In studies about the Ganges which articulate these representations with politics (notably Alley, 2002; Sharma 2009; Mawdsley, 2005; and Drew, 2017), two interpretations seem to emerge: some authors emphasize the instrumentalization of the religious Ganges symbol to achieve political ends -by

[9] As an exception worth noting, the book 'Dancing with the River' by Indian Geographers Kuntala Lahiri-Dutt and Gopa Samanta (2013), did not tackle these issues; it focused on erosion/accretion issues in the Ganges delta with the prism of communities' livelihoods.

Hindu nationalist politicians and by environmentalists mobilized in an anti-dam struggle (Sharma, 2009; Mawdsley, 2005); others instead point to the strength of the religious beliefs of river devotion and the everyday practices of river worshipping, as they positively or negatively shape political mobilizations and/or policy decisions towards the river (Alley, 2000, 2002; Drew, 2017; see also Haberman, 2000, 2006 for the river Yamuna or with a strictly religious focus, Anne Feldhaus, 1995 for rivers in Maharashtra).

My position is to acknowledge the relevance of both perspectives. As raised by Drew (2017), the first approach may overlook the way the river-human relation interferes in politics –in her work, Drew proposes to study the 'politics of everyday religious belief and practice' (2013, 17); the second may underestimate some other influential factors, such as distant frames of thoughts – for instance, international referentials or scientific frames, as well as the dialectical processes emphasized in the hydrosocial approach.

1.2.3 Research questions

My research work aims to address these gaps while reconstituting the history of the emergence of a Ganges 'problem' over the last forty years. Drawing on Muller's work and further to the introduction, I assume that there is a change of 'referential' towards the 'rejuvenation' of the river that is brought by the *Namami Gange programme*. I will therefore analyse the development of this new referential with an historical perspective.

The research has two overall guiding questions, one more empirical and linked to the questions of problem framing within environmental governance; the other more theoretical and linked to the development of the hydrosocial framework.

The empirical research question is as follows:

A. How does Ganges 'rejuvenation' emerge as a problem to be addressed by public action?

This question will be addressed through the following sub-questions:

A1. How has the Ganges been identified as an object of public intervention?

A2. How has the Ganges 'problem' been made visible?

A3. In this historical and gradual process of political and ecological redefinitions

of the river, what 'river meanings' are politicized, what 'river meanings' remain unaddressed?

Chapter Three will address the questions.

This research also pursues the aim to address a conceptual question related to the hydrosocial framework, thanks to the Ganges case. This doctoral work therefore seeks to address the following research question:

B. How to mobilize and further define the hydrosocial approach in river contexts?

This question will be addressed through the following sub-questions.

B1. How does the materiality of a river -that is not restricted to water flows- intervene in the hydrosocial cycle?

B2. How do emotional and symbolic attachments towards a river intervene in the hydrosocial cycle?

B3. How to further define the nature, roles and politics of 'river meanings' in the hydrosocial cycle framework?

Chapters Five and Six will respectively address the questions B1 and B2. The conclusion (chapter Seven) will address question B3.

The Table 1 summarizes the research sub-questions and mentions the related chapters, which address each of them.

	Research sub-questions	*Chapters*
How does Ganges 'rejuvenation' emerge as a problem to be addressed by public action?		
A1	How has the Ganges been identified as an object of public intervention?	Chapter Three
A2	How has the Ganges 'problem' been made visible?	Chapter Three
A3	In this historical and gradual process of political and ecological redefinitions of the river, what 'river meanings' are politicized, what 'river meanings' remain unaddressed?	Chapter Seven
How to mobilize and further define the hydrosocial approach in river contexts?		

B1	How does the materiality of a river -that is not restricted to water flows- intervene in the hydrosocial cycle?	Chapter Five
B2	How do emotional and symbolic attachments towards a river intervene in the hydrosocial cycle?	Chapter Six
B3	How to further define the nature, roles and politics of 'river meanings' in the hydrosocial cycle framework?	Chapter Seven

Table 1: Summary of research sub-questions

1.3 STUDY DESIGN

1.3.1 Overall approach

My approach is in line with the epistemological position of critical political ecology, which takes science seriously as the same time as questioning it (see for example Forsyth, 2003). In adopting political ecology frameworks, I subscribe to the post-positivist stances of this discipline. This approach contradicts both the ideas of 'facts speaking for themselves independently of the values and paradigms of the researchers' (Castree et al., 2013) and of a reality 'out there' that science ought to reveal while distinguishing the 'true' from the 'false'. Instead, 'representation and reality are seen as interlinked in dynamic and recursive ways' (Castree et al., 2013). As a consequence, science is understood as one among plural ways of knowing and interpreting what surrounds us and does not exhaust the question of what reality is.

These perspectives help to explain the choice of approach and methods. I adopt a post-structural political ecology approach that pays attention to discourses and knowledge construction and that is neither strictly materialist, nor strictly idealist. This approach also acknowledges its own normative aim to contribute to a more socially and environmentally just society.

This research relies on the following logic:

1. With the perspective of cognitive analysis of public policy that particularly addresses the genesis of public policy, the *Namami Gange programme* is at the same time the symptom and a reinforcement of a gradual change of policy

referential relating to the Ganges that is now considered sick and 'to be rejuvenated'.

2. This construction of a new referential can be studied in order to reconstitute the story of this change and to provide variables to explain it (Muller, 2013).

3. However, this referential refers to a river, i.e. a geographical, non-human but agential entity with which humans relate through uses, affects and representations. These features call for a more integrated analysis than the referential one that is a-geographic.

4. Post-structural political ecology is therefore a good framework as it studies politicizations of environment problems as well as human/non-human interactions. In this regard, mobilizing the hydrosocial analysis developed in political ecology of water is particularly interesting, as it proposes to study the following four dimensions (Linton and Budds, 2014):

    1. The meaning of water or views, discourses and understandings at stake;

    2. The internationalization and expression of political strategies and politics in water circulation;

    3. The relations to larger scales, external actors and moves;

    4. The water-society dialectic co-production.

5. As materiality matters in the hydrosocial cycle and as a river such as the Ganges presents a high biophysical heterogeneity along its course, the analysis must be conducted in contrasted sites of the river.

6. As the Ganges is a Goddess with whom devotees develop personal relations, the individual dimension of the human-river relation is also at stake in this context. The analysis will have to mobilize another theoretical framework to take this dimension into account. The *mésologie* of Augustin Berque (2014) thus provides additional insights for the analysis as it theorizes the 'milieu' or the historicized and mutually constitutive human-'environment' relation (see further development on this aspect in Chapter Three).

In the following sections, I will introduce how this approach will be operationalized, notably with three contrasted case studies that will present different policy stories.

1.3.2 Case study approach

To conduct this analysis, I use a qualitative 'case study approach'. What I name 'case study' here does not refer to a small-scale perimeter that the researcher empirically studies in a quite systematic and comprehensive manner. I instead refer to a unit of analysis that may be at a large scale – such as the River Ganges itself – but that can be conceptually represented as an entity, as a system. The investigations are thus of different natures according to the specific size and topics of the 'cases'.

In this research, I first investigate policies and discourses that target the whole river (and river basin) according to the approach of the 'referential' framework, notably the *Namami Gange programme* (addressing sub-questions A1 and A2). I then make a differentiated use of two other cases, while mobilizing the hydrosocial analysis. In the first case, the Lower Ganges Basin (West Bengal), which was investigated in collaboration with Dr. Jenia Mukherjee, an Indian Environmental Historian researcher, I particularly engage with the materiality of the river through its sediments (addressing sub-question B1). In the second case, a 130-km stretch of the Bhagirathi river in the Himalayan headwaters of the Ganges, from its glacial source to the city of Uttarkashi (Uttarakhand), I focus on how faith and ontological dimensions intervene in political strategies and river politicizations around the controversial *Gaumukh-Uttarkashi Eco-Sensitive Zone* policy (addressing sub-question B2). Finally, the three cases are mobilized in the reflections that address the sub-questions A3 and B3 relating to the 'river meanings' - the first one, empirically, the second one, theoretically.

1.3.3 Site choice and location of the cases

The choice of the *Namami Gange programme* within the investigation of the 'Ganges problem' is driven by the referential shift that it publicized (see the introduction section), as well as by the specificities of the geographical and cultural/religious context of the Ganges (see Chapter Two) that were enmeshed into the programme. Figure 1 presents the Ganges River Basin location.

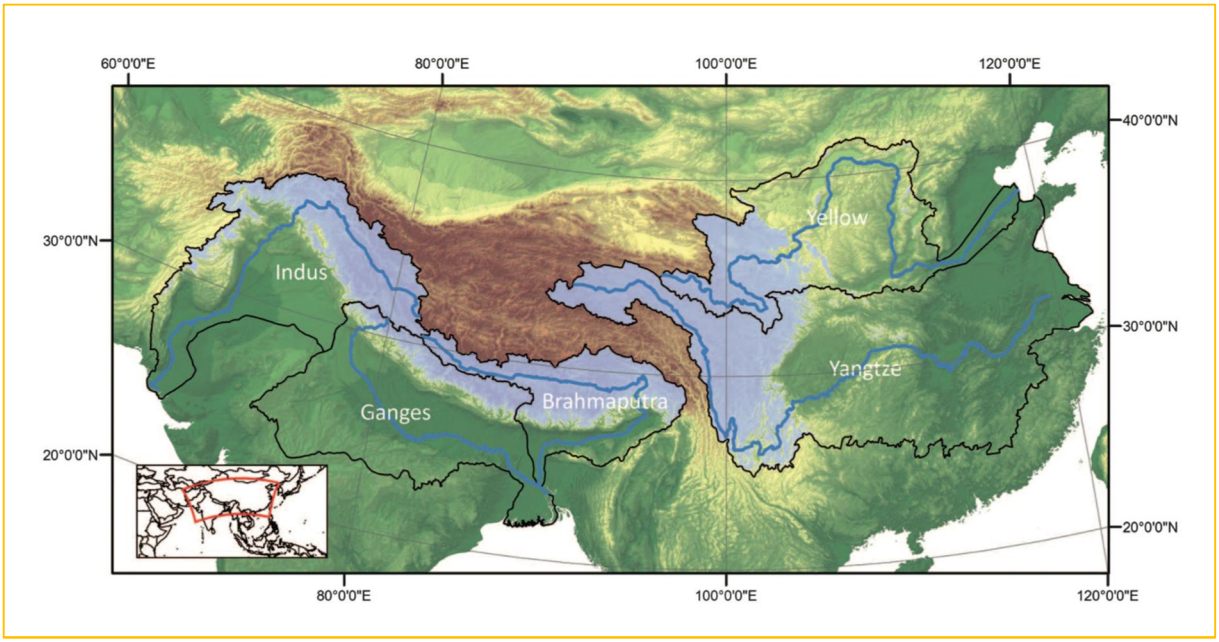


Figure 1: Location of the Ganges River Basin in Asia (From Immerzeel et al., Science, 11 June 2010, p. 1383. Reprinted with permission from AAAS).

The two other cases were mainly selected for their potential productivity for the analysis: the assumption was that reflecting on two contrasted areas that somehow escape the dominant imaginery related to the Ganges would yield more findings in relation to river meanings. They particularly present three interesting features in this regard. First, their sites represent two extreme biophysical features of the river: the Himalayan source of the river and its delta as it empties into the Bay of Bengal. In both regions, the river has been largely transformed by human interventions, notably with dams, barrages or embankments. The physical geography section (Chapter Two) will describe the characteristics of the river and its foodplains.

Second, both sites are also charged in religious symbols: the Gaumukh-Uttarkashi stretch of the Bhagirathi River encompasses highly praised pilgrimage places at the holy source of the Ganges (see Chapter Two, the sacred geography section); in the delta, one finds Sagar Island, another Hindu pilgrimage site where the confluence of the river and sea at the Bay of Bengal is worshiped. This site thus represents an interesting counterpoint to the Gaumukh pilgrimage site that represents the "birth" of the River.

Finally, each site also provides a singular story in relation with the Ganges, which justifies specific case studies:

- the Gaumukh-Uttarkashi stretch of the Bhagirathi River in the Upper Gangetic Basin in Uttarakhand State (altitudes between 1200 and 4000 metres above sea level) and the related watershed basin are labelled an *Eco-Sensitive Zone* (see Figure 2 for location, with Gaumukh and Uttarkashi in red circles). The Central Ministry of Environment and Forests notified this decision in 2012 under the Environment (Protection) Act, 1986. However, this decision is highly controversial and refers to a tense and twisted political process between pro- and anti-dam coalitions that emerged in 2005 and is still going on. Religious 'river meanings', river politicizations and political strategies are therefore key in this narrative.

- the lower Ganges basin within West Bengal includes broad floodplains in the lower reaches of the Ganges and part of the grand Ganga-Brahmaputra-Meghna delta, which comprises the largest mangrove zone in the world (see Figure 3 for location). Colonial 'scientific' river management (Gilmartin, 1994), land-based economy (Lahiri-Dutt and Samanta, 2013) as well as postcolonial policies (notably the construction of the Farraka barrage to reduce the siltation of Calcutta port) have aggravated riverine erosion and flooding with dramatic implications for the people and the ecosystems (Mukherjee, 2011). Physical processes, livelihood strategies and river control paradigms are here predominant.

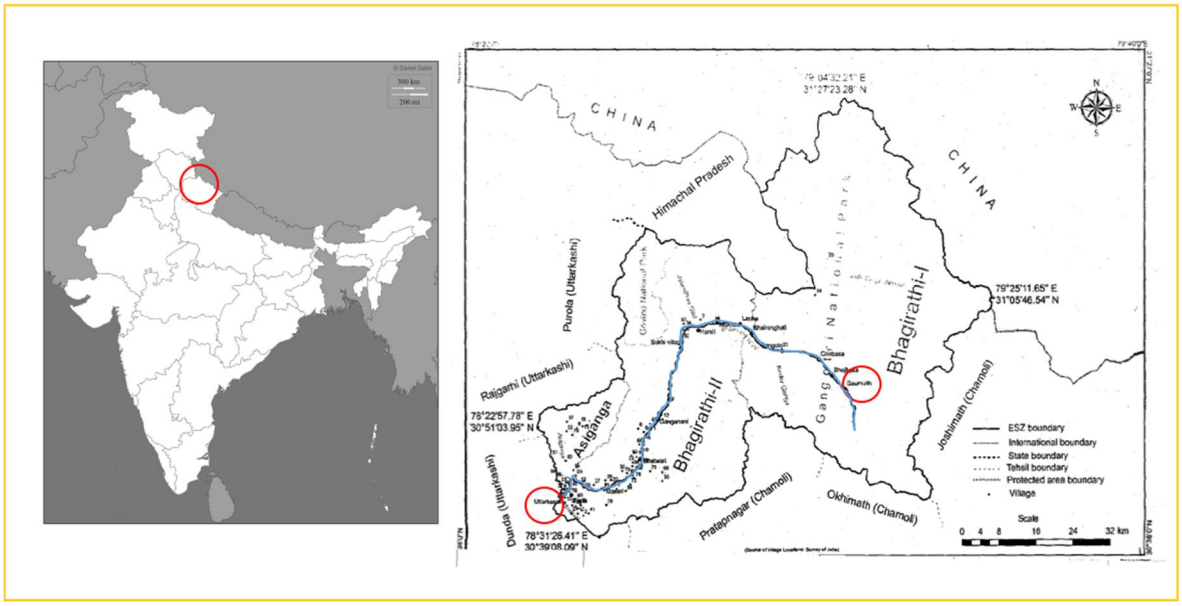


Figure 2: The Gaumukh-Uttarkashi Eco-Sensitive Zone (source: ESZ notification by the Ministry of Environment and Forests, MoEF 2012).

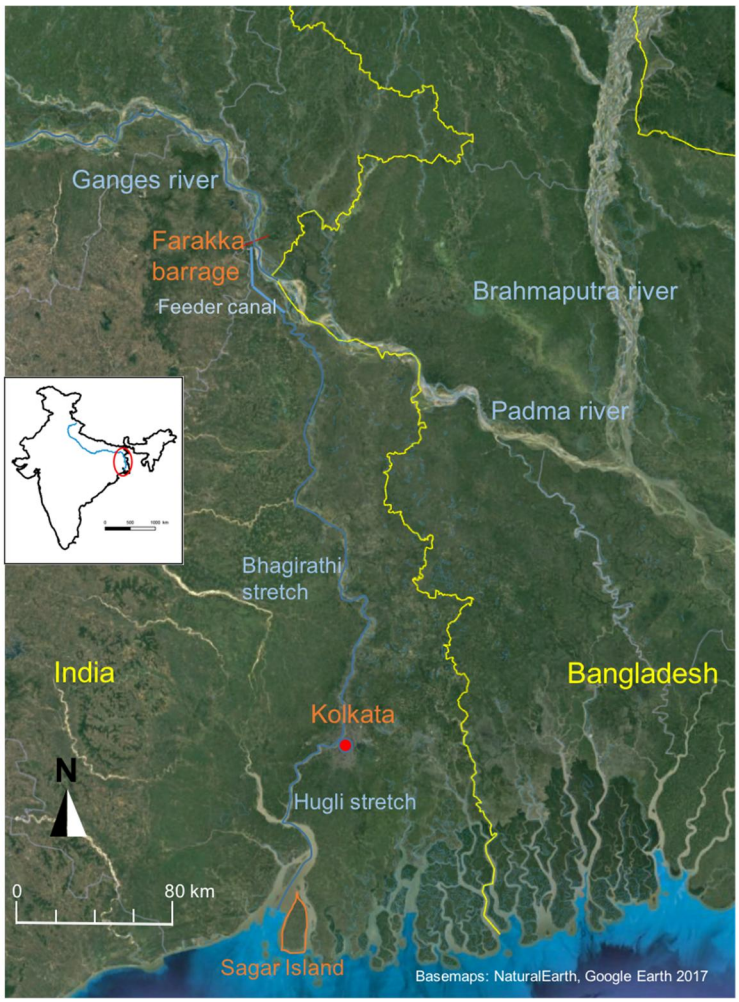


Figure 3: The location of the Lower Ganges Basin

I investigate the three cases with three different methodological approaches that are presented in the next section and again detailed in each relevant chapter or paper. I could not develop ethnographic studies among communities because I did not have the required resources (local language fluency, ethnographic know-how, availability for long-term stays). However, I associated for all cases collection of primary data through fieldwork and archival work, and collection of secondary data, principally from official press releases, press reports and grey literature (see further details in the section 1.3.5 and in Appendix 4). For the Uttarakhand and West Bengal sites, there was no obvious difficulty to collect either archival data (for example, colonial gazetters), or secondary documents[10].

[10] Most administrative documents are today accessible on the web sites of the central, state or district administrations as the development of e-governance and e-administration has been favoured in India since the

1.3.4 Methodological approaches

This section presents the different approaches and methods that I engaged for addressing the research sub-questions presented above. Further information is displayed in the Research Logframe in Appendix 3 that presents information required, methods to access them and related assumptions. To guide my approach, methods and fieldwork, I relied on the writings of authors such as (Sardan, 2004), (Quivy and Campenhoudt, 2009) and (Beaud et Weber, 2017).

Sub-questions A1, A2 and A3

To address the sub-question A1 relating to the emergence of the 'Ganges problem', I rely on academic literature and secondary data for historical accounts. To document the recent change of referential (sub-question A2), I rely on mainly semi-structured interviews on one hand, and on administrative documentation and press reports, on the other hand. This latter approach is expressly recommended by Pierre Muller (2013) in order to capture both the overall structural constraints and the actors' own influences, through the work over meanings they operate. Thus, he suggests mobilizing in parallel interviews and press reports/documentation. On one hand, interviews are key to decipher actions and decisions of policy-makers and to prioritize the information collected through press or grey documentation; on the other hand, press reports and documents are essential to precisely assign dates and to verify the information given by informants (Muller, 2013). For the high-level personalities like Ministers or Ministry's secretaries, or for some key figures I could not get the opportunity to directly interview, I also rely on rigorous secondary data[11]. For example, the Indian governmental press releases that reproduce official discourses are published by the *Press Information Bureau* (PIB) and remain available on the PIB's website. Grey documentation produced by governmental or non-governmental organisations has also been largely exploited as it represents an abundant source of discourses produced on the river. The analysis that was

early 90's and notably since 2006 with the National e-Governance Plan. English versions of the documents are almost always available too.

[11] As I did not aim to capture 'hidden' information but on the contrary, how the actors express their goals and priorities, in their own terms, official discourses or official interviews conducted by the Indian press or radio (e.g., All-India Radio) were thus of great help for my research.

required to address sub-question A3 was conducted with further grey literature and press material.

Sub-questions B1 and B2

For sub-question B1, research took place within a collaboration funded by the Indo-Swiss Research Exchange Programme in Social Sciences 2016-2017. This grant facilitated my collaboration with Dr. Jenia Mukherjee, an environmental historian affiliated to the Institute of Development Studies Kolkata in 2016, then to the Indian Institute of Technology, Kharagpur in the department of Humanities. Our approach combined political ecology and environmental history, through the analysis of past and present moments of the hydrosocial cycle that incorporates sediment in the river-society relations. For the Lower Ganges Basin case that we jointly explored, we drew on Dr. Mukherjee's past research, notably on Bengal's colonial archives and on the field in Murshidabad and Malda districts. I conducted new interviews and field visits on the same field sites in order to update the information she collected years before, as well as to advance the theoretical outcomes of our work. In addition, my main contribution in regard to data collection was to gather secondary data related to the physical and ecological processes related to sediments in this river stretch and to exploit it.

For the sub-question B2, the aim was to retrace the history and developments of the *Eco-Sensitive Zone* (ESZ) decision, as well as to access the main meanings of the river within the discourses that actors mobilized in the political process. As for the questions A1 and A2, this approach differs from an ethnographic study for which I was not skilled. The investigation focuses on political discourses and strategies. The targeted actors belong to the 'policy community' as termed by Muller (2013), i.e the people that are directly or indirectly involved in formulating the referential of the ESZ policy. The case study information is then gathered from archives (notably from a non-profit research and development organisation in Dehradun, which had constituted its own archival material on the whole process), reports, online materials (campaigning websites or blogs, e-administrative documents) and interviews. This constitutes a large corpus of published and unpublished discourses related to the conflict.

Sub-question B3

This sub-question is addressed in conclusion. It is mainly a theoretical question

that mobilizes the previous data and analysis from the three cases. It did not require additional data.

1.3.5 Fieldwork

For fieldwork, I spent six stays in India in the period November 2015 to October 2017, with durations varying from ten days to four weeks, totalizing about four months of fieldwork (see Table 2). These stays and my observations were facilitated in many ways by the four years I spent previously in India, from September 2010 to August 2014. I was then posted in Delhi at the Embassy of France, Regional Economic Department as Sustainable Development Counsellor seconded by the French Ministry of Environment. During that time I undertook several professional and personal travels in the Himalayan region, in Uttar Pradesh, in West Bengal, in Maharashtra as well as in the south of the country, in Kerala, Tamil Nadu and Pondicherry territory. Among other topics, I encountered Ganges management issues and I had opportunities to regularly interact with officials, organisations, think tanks and companies as well as with some NGOs on water subjects in India. One of my missions was to initially coordinate, then monitor the progress of a 15-month consultancy work conducted by a French company for the *National Mission Clean Ganga* bureau in Delhi, with Government of France's financial assistance[12]. In 2015, I also conducted a consultancy work to review the draft Indian Water Framework Law, 2013 and to compare it with the European Water Framework Directive, as a mandate for the European Commission and the Indian *National Water Mission*[13]. I presented the outcomes of this work at the first Indo-European Water Forum in November 2015 in Delhi.

Beyond a lasting immersion in the Indian context and the development of some

[12] The financing framework, FASEP, is designed to bring technical assistance via studies or innovative small-scale projects in order to showcase French expertise. This particular work (2011-2012) aimed at fast-tracking the effective launch of the World Bank's assistance programme of 1 billion dollars to the Indian Government for its Clean Ganga Mission.

[13] The report is available at http://eeas.europa.eu/archives/delegations/india/documents/report_review_india-eu_water_legislation.pdf. From 2002 to 2010, I was in charge of preparing and then implementing the prescriptions of the *European Water Framework Directive*, 2000 in the Languedoc-Roussillon region, France. This involved a dense and collective science-policy interface work to translate advanced scientific knowledge, still under construction, into policy and concrete measures to be implemented by various stakeholders (state, regional and local public actors, as well as private players).

empirical knowledge on water issues and governance in India, these experiences more practically helped me to conduct 'productive' fieldwork during my doctoral studies. It notably taught me the procedures to obtain meetings with officials and then, how to interact with them in an interview without compromising the chances to get information. This was essential for me, as I could not, for family reasons, spend long stays in India during this research.

The fieldwork for this research took place:

- in the national capital Delhi, where I met several governmental officials, organisation representatives (like World Bank or WWF) as well as environmentalists;

- in Dehradun and Kolkata, the State capitals of both sites (Uttarakhand and West Bengal) and in District capitals, in order to meet State and District administrations (the district of Uttarkashi in Uttarakhand; and the districts of Murshidabad, Malda, and 24-Parganas in West Bengal). There I also met with scholars, activists, scientists and some key figures involved in the struggles around the local Ganges issues.

- finally, in the upstream valley of River Bhagirathi, from the glacier source Gaumukh to Uttarkashi and down to the Tehri dam, in Uttarakhand; in the lower stretches of the Ganges, upstream (Malda district) and downstream (Murshidabad district) of the Farraka barrage, and in the delta down to Sagar Island and the Kapil Muni temple pilgrimage site. I visited then block administrations and also informally or more formally met with local residents, activist and religious figures. In the lower Ganges basin, I managed to visit sites at both dry (February) and monsoon (July) seasons. The purpose was to experience the landscapes and to grasp an understanding of the uses and the interactions with the river in both contrasted situations. I was only able to visit the upper Bhagirathi valley in mid-September, just at the end of the monsoon season, when the river level was high. The weather was too rainy and stormy in early July 2016 to allow a secure drive from Dehradun to Uttarkashi and Gangotri[14].

[14] Road damages just occurred on the national highway few days before my planned trip. The driver, a 'wise' man I had carefully selected for that trip, recommended to cancel it. We finally drove together up to Gangotri in September 2016.

In order to complement my understanding of the local, regional and national issues, I initiated several interactions with Indian scholars and with foreign scholars or diplomats residing in India[15]. For further insights on my field sites, I notably interacted with *Doon University,* the University of Uttarakhand State based in Dehradun[16]. I conducted a 7-day joint fieldwork in the Bhagirathi Valley up to the Gaumukh Glacier with 2 local researchers from the university and a student, who greatly helped me for Hindi translation and contextualization during the field. In West Bengal, I benefited from a great academic and logistic support from the *Indian Institute of Kharagpur* (IIT Kharagpur) thanks to the Indo-Swiss Research Exchange Programme. My colleagues of IIT Kharagpur, Dr Jenia Mukherjee and Professor Baghirath Behera, or one of their PhD students assisted me with Bengali translation in the field.

	Duration	*Sites*	*Period*
Immersion in Indian national and state environmental policy contexts	4 years	Delhi, States of Rajasthan, Uttar Pradesh, Uttarakhand, Himachal Pradesh, West Bengal, Kerala, Tamil Nadu, Pondicherry, Maharashtra.	September 2010-August 2014
Fieldwork 1	10 days	Delhi, West Bengal (Kolkata)	November 2015
Fieldwork 2	3 weeks	Delhi, Uttarakhand (Dehradun)	July 2016
Fieldwork 3	3 weeks	Delhi, Uttarakhand (Dehradun, Uttarkashi district, Bhagirathi valley)	August-September 2016
Fieldwork 4	4 weeks	West Bengal (Kharagpur, Kolkata, Murshidabad district, 24-Parganas North and South districts)	February 2017

[15] For those interactions, I could mobilize the network of friends and professional interlocutors I had built during my past position at the Embassy of France.

[16] I was invited to give lectures to Master students from the Environmental Sciences Department in September 2016.

Fieldwork 5	2 weeks	West Bengal (Kharagpur, Kolkata, Malda district), Delhi	July 2017
Fieldwork 6	10 days	West Bengal (Kharagpur)	October 2017

Table 2: Summary of fieldwork stays in India

1.4 METHODS AND DATA MANAGEMENT

I now present the ways I collected data during my research process. I present the primary data collection, the secondary data collection and finally, the data analysis and management.

1.4.1 Primary data collection

1.4.1.1 Interviews

The list of interviews (see Appendix 4) distinguishes between semi-structured interviews and other types of interactions such as discussions that developed without formalized appointments. There were also many more informal interactions than those reported in the appendix (see section 1.4.1.2). The reference to semi-structured interviews relate to methodologies that are precise (see Quivy and Campenhoudt, 2009). They are preceded by a formal request to the interviewee. A dedicated slot of time and an adequate space are required for it, provided by the interviewee. They are systematically followed by a written transcription or a written report by myself[17]. I mainly conducted in-depth interviews and semi-structured interviews. I tape-recorded only some of the interviews, as I knew for most officials, this would make them less comfortable and less ready to share time and information with me. However, I developed during my previous professional positions an alternative method that is relatively efficient. I rapidly take abundant notes, with a kind of personal 'script', while listening and interacting with the interviewee. I used that method during this

[17] English is the medium systematically used for these interviews. The interviewees either activists, scientists, scholars or belonging to administrative spheres with a certain rank, were all comfortable with this language (all the time, more fluent than me). I discovered though for one interview, while hearing it again, that the interviewee was maybe not as comfortable with the language as the impression I got during the interview. For that interview only, I think that the language issue has in some extent altered the expression capacity of the interviewee.

research, even in case of tape-recording interviews. This method allows me to keep track of the exact words or expressions employed by my interlocutor, even in absence of tape-recording[18]. I however keep the contact with the interviewee by (very often) verbal signs of 'confirmation' of my understanding and interest, as well as by regular eye-contact. I also don't hesitate to interrupt or to ask for further precisions, if required. Thus, taking notes did not impair the dynamics of the interviews.

The selection of the formal interviewees was strictly prepared. I did not have the possibility to multiply them, as I was time-constrained during my fieldwork. In order to select the persons, I used press reports, administrative websites, as well as official minutes of meetings, where I could find additional suggestions of key persons to interview. I also used the web to check the biographical trajectory of the person, his/her writings, etc. when available, in order to better prepare the discussion[19]. I finally took opportunity to conduct more interviews in a short time-span using the snowball approach, when appropriate. For example, thanks to the network of our colleagues from IIT Kharagpur, I had the opportunity to interview some *Indian Institute of Technology* (IIT) scientists who were involved in the important elaboration process of the *River Ganga Basin Management Plan*, driven by a consortium of seven IITs in the years 2010-2015.

The interviews aimed at providing three categories of information: 1. direct discourses as a primary data; 2. detailed data for triangulation and crosschecking; 3. information for data contextualization. In this regard, I systematically considered *a priori* the interviewee as an informant whose own knowledge, analyses and perspectives could enrich the contextualization of my overall data, collected in other spheres. Therefore, I also mention in the

[18] In this research, I could compare my notes and the results of some tape-recording transcripts; I could see that there is some loss of information, but most of the time, it remains limited. I generally didn't miss the key ideas (anticipated or not) or the key expressions. However, I concluded that recorded interviews are preferable, if the possibility is offered.

[19] I had nevertheless some surprises, like in 2016, when I discovered how much the head of the *People Science's Institute* in Dehradun I planned to interview about Ganges' general issues (because of his contribution to reflections on Ganges' ecological flow and of his name being recorded among the participants of the *Ganga Mathan* in 2014, organized by the Minister of Water Resources in Delhi) had been a key player, mainly from backstage but also officially, in the *Eco-Sensitive Zone* process since 2008. I had for example missed that he had been associated to the *National River Ganga Basin Authority* as an expert (and could attend its meetings chaired by the Prime Minister), and that the Supreme Court, via the Ministry of Environment and Forests, mandated him to chair a Committee to assess the roles of dams in Uttarakhand 2013 tragic flash-flood.

Appendix 4 a list of interactions that were particularly useful in this regard, whatever their duration, which could vary from a few minutes up to two hours. They differ from the interviews in the sense that they were not necessarily planned. Sometimes, following advice from Beaud et Weber (2017), these interactions were strategies that were improvised on the spot to overcome some difficulties encountered during the fieldwork.

1.4.1.2 Participant observation and informal interactions

To gather more observation of the current governance and technical issues debated in national arenas about rivers, I conducted participant observation in some meetings. I participated to seminars and workshops jointly organized by the Indian ministry of Water Resources and the European delegation in India about river basin management (23-24 November 2015) and about water allocation, water economics and ecological flows (14-15 September 2016) in which officials and experts from different states, countries and from the World Bank participated. In the 23-24 November 2015 First Indo-European Water Forum, I was able to listen to allocutions delivered by the Minister of State of the Ministry of Water Resources, the Secretary of the Central Ministry of Water Resources as well as the Mission Director (*National Mission Clean Ganga*), who presented the *Namami Gange programme*.

In addition, I got invited to the *Rivers Week 2015* event on 28 November 2015, organized by a consortium of leading environmentalist organizations (*INTACH*, *SANDRP*, *WWF-India*, *Toxic Links*, *Gandhi Peace Institute*) in Delhi, where I attended project-oriented presentations as well as more political interventions (for example, the Delhi Government Water Resource Minister, Kapil Mishra). At this event, I was also able to directly access additional documentation from these organisations. I also gave some support to the design of a Quality Improvement Programme short-term course for the All India Council for Technical Education teaching staff, at IIT Kharagpur during 23-29 October 2017. This short-term course, organized by assistant professors Dr Jenia Mukherjee and Dr. Anuradha Choudry from the Humanities and Social Science Department, addressed the following topic: 'Combining hydrology and hydrosocial: towards comprehensive understanding of riverine systems'. During my presentations, as well as more informally during the week, I also benefitted from sharing views and insights with the other speakers and participants, who had experience in fluvial

geography, river management and water-related cultural fields in the Indian context.

Informal interactions were numerous on such occasions of participant observation, as well as in field visits. English was again the main medium for those interactions in cities like Delhi, Dehradun, Kolkata, Kharagpur as my interlocutors were all fluent in English. However, in smaller places in West Bengal or in Uttarakhand, I required translation services. As I mentioned earlier, some Indian research scholars from the Doon university or from IIT Kharagpur systematically accompanied me for the field visits in the ESZ region as well as in the Bengali *chars*. I thus did not need to hire any assistant for the translation. This happened in a kind of flexible way, and the discussions with residents (men and women), pilgrims or professionals often turned into group discussions rather than bilateral ones. The transcription of these discussions and interactions was not systematic[20] but I systematically kept written trace of the main ideas or of the striking exchanges in various personal writings (notebooks, field journal, early analysis attempts in separate writings).

1.4.1.3 Call for Indo-Swiss research exchange programme – UNIL/IIT Kharagpur proposition

I mention this research exchange here, as it was a strategic approach to make possible the acquisition and analysis of data in the Lower Ganges Basin. Without this collaboration, the case study as it is would have not existed: first, the focus on sediments was a suggestion brought by Dr. Jenia Mukherjee at the beginning of our joint work[21]; second, the amount of knowledge on the particular Bengal context and the required primary data would have been too large to be apprehended by myself alone in parallel to my two other case studies. Dr. Jenia Mukherjee also brought her skills and her past work in environmental history that were required for the elaboration of the *Environment and Planning E* paper (Chapter Five).

[20] I did not realize until the end of my fieldwork that I could have more formally exploited these sources of information through transcripts and codes.

[21] On my side, I brought the proposition of a joint hydrosocial exploration of the Ganges delta. I presented the hydrosocial cycle framework in November 2015 in front of an audience of the *Institute of Development Studies, Kolkata*. Dr. Jenia Mukherjee, who had invited me, enthusiastically jumped into the proposition and actively prepared the Indian contribution for the call. Prof. Christian Kull, *UNIL*, then Prof. Bhagirath Behera, *IIT Kharagpur* joined too and contributed to the success of this exchange programme.

1.4.2 Secondary data collection

The secondary data collection was an important task of this research for two reasons. First, the primary data collection for each case is thinner than in classical political ecology investigations: the choice of two contrasted and geographically distant cases exerted organisational and time constraints on the fieldwork. Second, there is a profusion of academic writings (mainly out of social science literature), official information, grey literature, press reports and activist publications on the Ganges subject. In order firstly to get an overview of the current debates and productions, secondly, to classify and then prioritize the documentation, I have subscribed since the beginning of my research in 2015 to a Google alert with the terms 'Ganges' and 'Ganga'. The latter term is largely more productive with about one to five meaningful articles per day that are collected from the online Indian Anglophone press. Through this way, beyond technical debates, I could monitor political interventions and discourses from the government or from various oppositions. I regularly copied and classified the most interesting articles in a dedicated folder structure that was thematic. The numbers of themes tended to grow along with the research; this required a reorganisation of those themes during the data analysis phase.

On the suggestion of an interviewee, I also collected an All-India Radio programme ('Public Speak') dedicated to the *Namami Gange* programme with questions of the public simultaneously addressed to the Director of the *National Mission Clean Ganga* and to an environmentalist. The transcript of this audio programme was prepared and translated to English by a student from Doon University.

Most of the grey literature was collected via the web. Few documents I collected through direct contacts were not accessible on websites. I systematically collected the reports produced on the Ganges by the main governmental agencies or by public research institutes (Central Pollution Control Board, the consortium of IITs which produced more than fifty reports in the process of the *River Ganga Basin Master plan*, Central Water Commission, National Environmental Engineering Research Institute, National Hydrology Institute, etc.). I also collected reports from leading environmentalist organisations like the Centre for Science and Environment, South Asia Network of Dams, Rivers and

People, WWF-India or Wildlife Institute of India. In addition, I relied on international academic works to prepare the physical geography section presented in Chapter Two.

Specific secondary literature and documentation for the Uttarakhand and West-Bengal cases were also gathered. For example, for the ESZ case, I collected affidavits and tribunal decisions as well as some public information and specialised press reports on hydroelectricity issues; for the Lower Ganges Basin, I collected statistical reports on fish production from the State Department of fisheries, or district and block reports relating to disaster management. The mobilized documentation is specified in the related papers (Chapters Five and Six).

For the historical accounts, I mainly relied on academic literature though I did access some colonial gazetteers in Indian libraries (Indian International Centre, Delhi for the Dehradun gazetteer, and National Library, Kolkata for Bengal gazetteers). Among the secondary documentation I directly exploited, I made use of the five-year Plans (period 1951-2017) published online by the Planning Commission as well as the First Citizen's report on the Environment in India from Centre for Science and Environment (CSE, 1982).

Finally, I strictly relied on academic literature to draw the 'Sacred geography' section in Chapter Two – whose title I borrow from Diana Eck. I made use of several works such as (Rosu, 1999; Haberman, 2000; Darian, 2001; Alley, 2002; Singh, 2011, 2013; Eck, 2012; Drew, 2017).

1.4.3 Data analysis and data management

For the data analysis, I relied on two tools: classification and interpretation. The classification I used was different according to the cases. I principally made use of electronic classification as the main part of my data was in electronic format (grey literature, press articles, photos of archival material and photos from the field visits). I did not make use of discourse analysis tools. I oriented my investigations not to require such tools as I chose to focus on narratives (sequences) and processes.

For data prioritisation and interpretation, I relied 'cross-interviews' of experts and informants, and on snowballing. 'Cross-interviews' is a way to build on

previous interviews to test ideas and assumptions of some interviewees with next interlocutors. In this regard, I deliberately fostered exchanges within interviews that allowed me to benefit from the knowledge and analytical skills of my interlocutors. Most of my interlocutors were themselves well informed about the issues we discussed and had developed for their own purpose a kind of data collection and data analyses. Their comments and reflections, or their advice concerning useful data, helped me to enrich my understanding of the data to be prioritized or additional directions to the analyses. In the same vein, I also purposely interviewed external actors who were involved in research work on political or water issues in India, as well as diplomats who observed the Indian political scene. These interviews were not used as primary sources but as secondary information or for triangulation. I also triggered several exchanges in Switzerland, India, France and USA with senior researchers such as professors as well as post-doctoral students and peers to discuss research approach and methodology, in order to adjust and improve the orientations of my work along its course. I identified that strategy from the beginning of my research thanks to the exercise of preparing a 'research logframe' (see in Appendix 3). Preparing that document required me to identify the sources of information and the methods to access them, as well as the related assumptions, risks and alternative strategies.

I did not develop a formal data management plan during this doctoral work. However, I kept consistency for metadata (file naming for instance, including dates). The data I collected and analysed is stored under *Switchdrive* files, which allow for secured data storage (cloud storage under agreement with University of Lausanne). For long-term data preservation and data sharing, I will consider linking my dataset to *FORSBASE* or *ZENODO* if appropriate, as the largest part of my dataset is composed of secondary data.

1.5 ETHICS

This research raises no particular ethical issues. There is no conflict of interest involved in this research. The interviews were undertaken respecting principles of informed consent with adult volunteer participants. The quotes are anonymized. No regulatory issues were raised concerning the field visits.

In my sense, conducting ethical research as a researcher in a foreign country is crucial. The challenge is even more difficult than in one's own country, as the risk of making mistakes in the interpretations or during interactions is higher. That is the reason why I wish to avoid criticizing actors from the country I study, even with solid argumentation. I personally prefer to opt for a more neutral approach, thus taking some distance with some highly critical political ecology texts.

1.6 STRUCTURE OF THE THESIS AND OVERVIEW OF THE RESEARCH PAPERS

This section presents the structure of my doctoral work that is a kind of hybrid between a 'monograph' and a 'paper-based thesis'. The full thesis encloses three research papers presented in Chapters Four, Five and Six. Chapter One develops the research agenda and the methodology. Chapter Two introduces the readers to the socio-nature of the Ganges, with some physical geography insights on the river basin as well as some elements of its 'sacred geography'. Chapter Three presents the results of the analysis of the construction of the current Ganges' environmental 'problem' embodied in the national *Namami Gange* programme. Chapter Four addresses theoretical questions relating to the mobilization of the hydrosocial framework in river contexts. Chapters Five and Six advance these reflections in relation with two cases, in the lower Ganges basin in West Bengal (Chapter Five) around sediment issues, and at the source of the Ganges around the *Gaumukh-Uttarkashi Eco-Sensitive Zone* (Chapter Six). The conclusion sums up the research results and proposes theoretical insights about river 'meanings' in the hydrosocial framework. It also draws perspectives for further research and comprises some recommendations to policy-makers.

The core of the thesis is three article manuscripts. The first one (Chapter Four), published in French in the Swiss journal *Géo-Regards*, is a conceptual paper developed from literature review and from reflections on what a river is. An updated English translation of this article is also currently proposed for a special issue on 'New Epistemologies of Water' of the Indian INSEE *Ecology, Economy and Society* journal. It bridges political ecology and Berque's mésologie to develop a relational approach of rivers that gives attention to the geographical,

discursive and metaphoric as well as ontological dimensions of the river-society relation. For this co-authored paper by Professor Christian Kull and myself, the roles of the authors were as follows: I conceived the idea, did the research, and wrote the first draft; Pr. Christian Kull contributed conceptual ideas and revised the writing. I led the revision processes and the responses to the editorial board, with the insights, suggestions and writing revisions from Pr. Christian Kull.

The two other manuscripts are case-based and mobilize the hydrosocial framework. The second paper (Chapter Five), published in *Environment and Planning E*, analyse hydrosocial moments over history in the lower Ganges basin. It highlights how a hegemonic land/water conceptual divide infuses governing paradigms of the waterscapes. It argues for further engaging hydrosocial analyses with river's materiality, here sediments, over space and time. For this co-authored paper by Dr. Jenia Mukherjee, Pr. Christian Kull and myself, the roles of the authors were as follows: Dr. Jenia Mukherjee conceived the idea, did the historical research, and wrote the first draft. We jointly reworked it and I presented it at the ASA conference (*Association of Social Anthropologists of the UK and Commonwealth*), Durham in July 2016. New drafts were jointly prepared further to the feedbacks received at ASA (notably from Pr. Nikhil Anand) and to Pr. Christian Kull's conceptual contributions and writing revisions. I prepared a revised draft with incorporation of physical geography inputs, new fieldwork, and the proposition of a sediment-enriched hydrosocial cycle, to be sent to *Environment and Planning E* journal. I also led the revisions in response to reviewers and the editorial board, with insights and writing revisions from Dr. Jenia Mukherjee and Pr. Christian Kull.

The third paper (Chapter Six), provisionally accepted at the *Journal for the Study of Religion, Nature and Culture*, presents how a specific ontological interpretation of the river intervened in the political and policy debates over a protected, non-dammable zone in the source region of the Ganges. This case highlights the interest of bringing insights from political ontology into the political ecology of water. For this single-author article, I benefitted from the guidance and revisions of the writing from Pr. Christian Kull. I presented this paper at a conference of the ISSRNC (*International Society for the Study of Religion, Nature and Culture*) and India-China Institute, New School (NY) in April 2017, and a revised draft at the Atelier 4, University of Lyon 3, UMR Environment, City and Society, thanks to

the invitation of Pr. Anne Rivière-Honegger, in April 2018. All these interactions with senior researchers contributed to improve the final paper.

CHAPTER 2 – THE GANGES RIVER, A *SOCIO-NATURE*[22]

This chapter aims to introduce the Ganges River, before moving to the chapters that present the core of the doctoral work - the theoretical discussion and the case studies. In this chapter, I wish to root the River Ganges in its physical geography in order to emphasize the river's spatial and historical materiality. This is the object of section 2.1. I also wish to evidence how the River illustrates the concept of socio-nature, i.e a hybrid co-product of nature and society. In this regard, I will detail in section 2.2 how the cultural interpretations of the river shape and are shaped by specific human-river interactions and practices, like pilgrimages, and how the River is said to shape and be shaped by people too. The cultural and metaphorical ways of interacting with the River may play a large role in governance processes as two of the case studies related to 'Ganges policy narratives' will show (Chapters Three and Six).

[22] See in section 1.2.1 for a definition of this term.

2.1 PHYSICAL GEOGRAPHY OF THE GANGES

This section presents a detailed overview of the physical features of the Ganges River and its basin. This section aims to point to the dominant physical processes at work in the basin that shaped and are still shaping the river. It provides insights on the context in which the issues of Ganges governance occur. The presented processes also include some anthropogenic influences that are significant at the basin scale. The biological component of the river system and its interaction with the physical conditions are however not presented here. Some of these aspects will be briefly introduced in the context of the lower Ganges basin (Chapter Five).

The key physical processes around the Ganges are: the seasonality of Ganges' flows due to the predominant contribution of monsoon rainfalls; the impact on the non–monsoon flows of the river of diversion for irrigation and groundwater extraction in the river-related aquifers during dry season; the considerable sediment budget of the river due to the Himalayan origin of many important tributaries; the dynamics of the river channels in the plains and the delta; the water quality issues from natural and anthropogenic causes; the worsening of flood, drought and water quality issues because of global climate change.

In this section, I use the English name "Ganges" – and not the Indian name "Ganga" – to stick to natural sciences approaches of the river. This section mobilizes secondary sources in hydrography, climate sciences, hydrology and geomorphology from Indian, Bangladeshi and various international authors.

2.1.1 Introduction to the Ganges river basin

The Ganges river basin is a component of the Ganges-Brahmaputra-Meghna (GBM) River basin (Figure 4). This transboundary river basin covers a total area of about 1.7 million square kilometres, distributed between India (64%), China (18%), Nepal (9%), Bangladesh (7%) and Bhutan (3%). The GBM river system represents the fourth largest freshwater outlet to the world's oceans, behind the Amazon, the Congo and the Orinoco river systems, with an average annual

discharge of 970 billion m^3 per year at the confluence in the Bay of Bengal[23]. The river system discharges the second largest amount of suspended sediments to the sea (average of 900 to 1200 million tonnes per year) after the Yellow River (Gupta, 2008, 3). The GBM delta, a tide-dominated delta, is one of the largest deltas on earth (Best et al., 2008).

The Ganges and the Brahmaputra are of Himalayan origin (in Tibet, Brahmaputra is named Tsangpo, then Siang in Arunachal Pradesh before entering the Assamese plains). They lie at an immense suture, where the northerly drifting Indian tectonic plate has collided into and subducted under the southern margin of the Eurasian Plate. Since 55 Ma, these tectono-geomorphic processes have created the highest region on the planet, folding and faulting the rocks up into the Himalayan Mountains and the Tibetan Plateau (Wohl, 2011; Tandon et al., 2014).

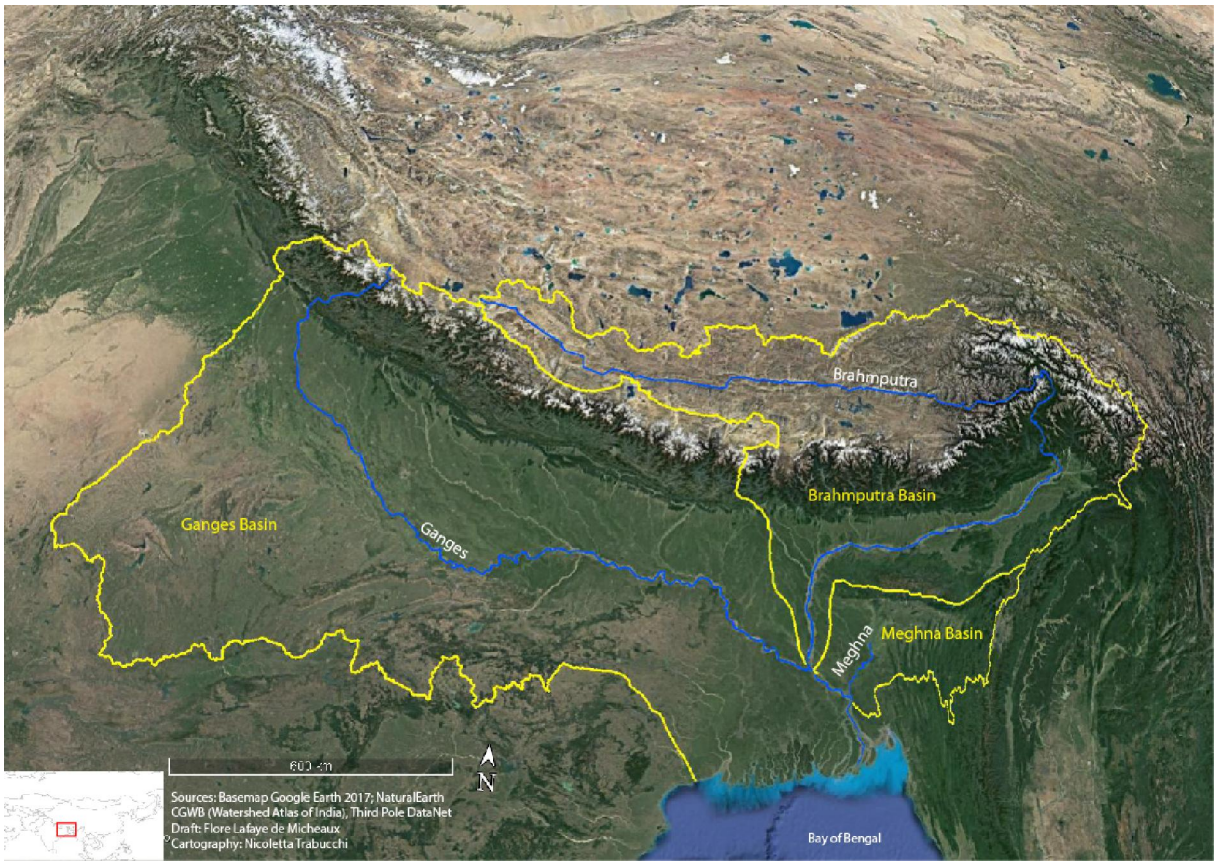


Figure 4: The Ganges-Brahmaputra-Meghna River basin

[23] For some comparison, the Rhine River in Europe has a river basin of 185 000 km2 and an average annual discharge of 80 billion m3/year (roughly about ten times less).

Within the GBM river system, the Ganges River basin is also a transboundary river basin, shared among India (79%), Nepal (14%), Bangladesh (4%) and China (3%) (Figure 5). It covers an area of 1.080 million square kilometres. Nepal is entirely located within the Ganges River basin, as well as 37% of the Bangladeshi territory (Rahman and Rahaman, 2017). In India, the Ganges basin is the largest river basin in terms of catchment area. It constitutes 26% of the country's land surface (861,000 square kilometres) and partly covers eleven States (Himachal Pradesh, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Rajasthan, Haryana, Delhi, Chhattisgarh, Jharkhand, Bihar and West Bengal).

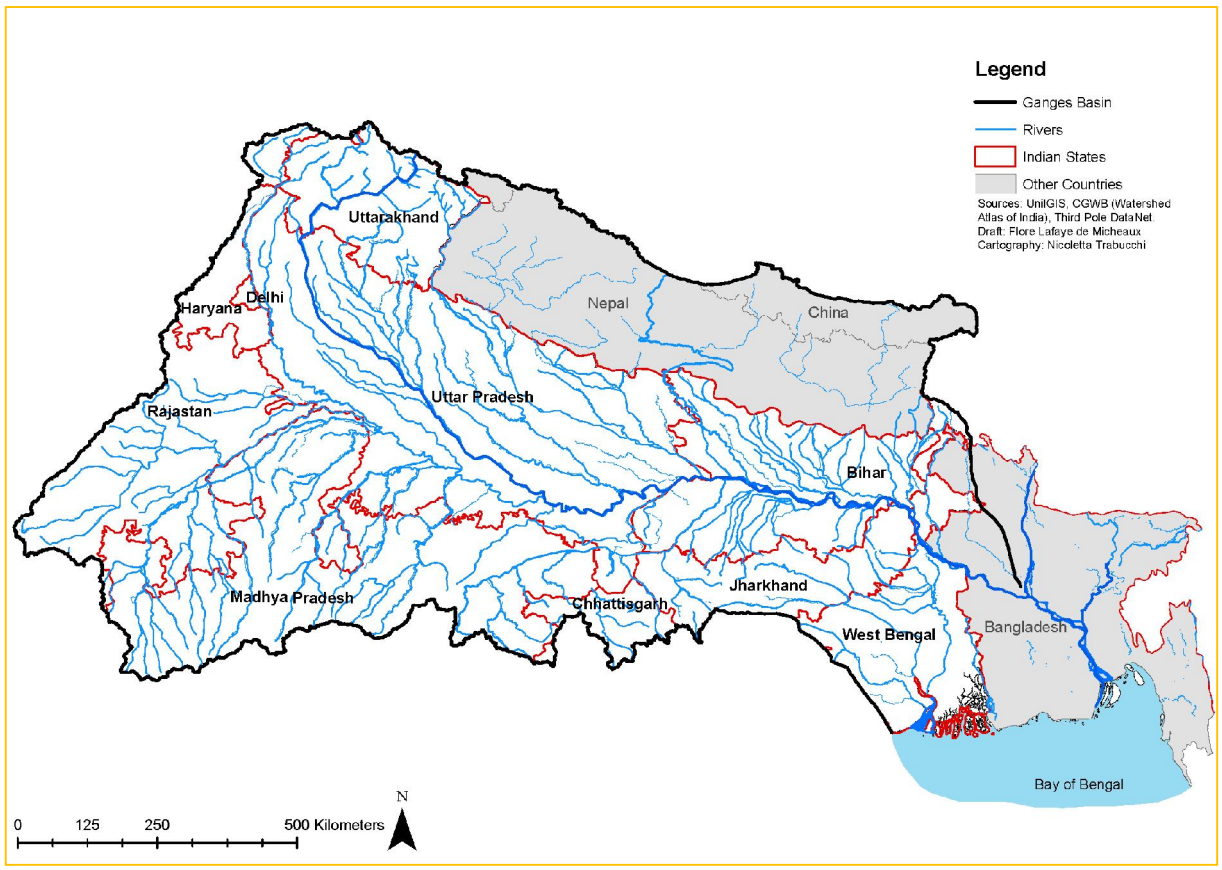


Figure 5: The Ganges River basin

2.1.2 Hydrography

In the upper Ganges basin, the Bhagirathi and the Alaknanda are the main source streams of the Ganges. They both flow in Uttarakhand, a State of India situated at the western part of the Himalaya. The southern edge of the State lies at about 200 kilometres northwest from Delhi (Figure 5). The Bhagirathi emanates from Gangotri Glacier at a place named Gaumukh (3,892 m above sea

level, a.s.l.), in the Uttarkashi district. The uppermost parts of this glacier lie at 7,000 m. This river is culturally labelled as the main source of the Ganges. The hydrologic source of the Ganges, the Alaknanda, begins its course at 3860 m in the Chamoli district. It originates from Satopanth Glacier and Bhagirathi Kharak Glacier and is joined by a main tributary, the Saraswati River from Tibet (China), at Mana (3200 m). Alaknanda and Bhagirathi Rivers join at Devprayag (830 m) in Uttarakhand, about 200 kilometres downstream from Gaumukh. At Devprayag, the river acquires the name Ganges or Ganga in Sanskrit. The total length of the course of the Ganges, usually considered from Gangotri glacier to the Bay of Bengal, is 2,525 kilometres; this is about the length of the Brahmaputra (2,900 km), the Danube (2,860) or the Indus (3,000) but far less than the Nile (6,500), the Amazon (6,000), the Mississippi (6,000) or the Mekong (4,880) (Gupta, 2007).

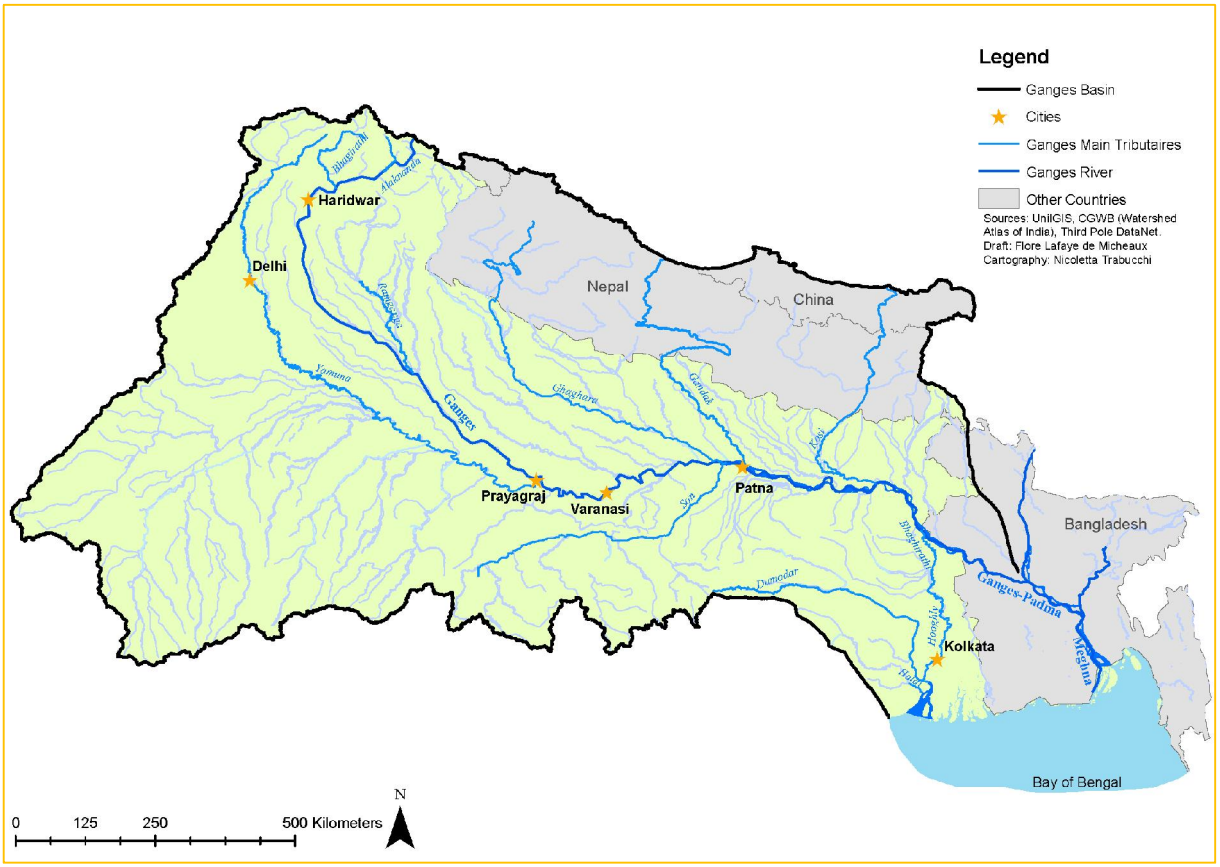


Figure 6: The course of the Ganges River and its main tributaries

Many of the northern (or left-side) tributaries of the Ganges River flow south and east from the Himalayan highlands (Figure 6). They represent larger quantities of

flows and sediments to the River Ganges than the southern (or right-side) ones, mainly originating from the Peninsular plateau. The latter are characterized by smaller altitudes of their head sources, except for the Yamuna River that is of Himalayan origin.

In Uttarakhand, at Haridwar (314 m a.s.l.), the Ganges opens to the Gangetic Plains. In the Haridwar– Prayagraj (formerly Allahabad) stretch, some flows are diverted from the main channel to feed canals in Haridwar (Upper Ganga Canal), Bijnor (Madhya Ganga Canal, in monsoon season only) and Nurora (Lower Ganga Canal). Beyond Allahabad (98 m a.s.l.), several important tributaries join the Ganges, mostly from the north (Punpun, Ghaghara, Gandak, Bhuri Gandhak, Kosi) and a few (Tons, Son) from the south (Figure 6).

In the lower basin of the Ganges, the River enters the West Bengal State in the Malda district. After some 35 kilometres, at Farakka (approx. 12 m a.s.l.), the Ganges bifurcates into two major branches, the Padma River and the Bhagirathi River. The Padma River, here the main stem of the Ganges, flows in a southeast direction towards Bangladesh. It meets the Brahmaputra River about 113 kilometres downstream of the Indo-Bangladeshi border. The Bhagirathi River flows to the South, towards the city of Kolkata and the Bay of Bengal; it remains in India. The commissioning of a diversion structure on the Ganges in 1975, the Farakka Barrage, put an end to the natural degeneration of the Bhagirathi channel. The Bhagirathi River now flows from a 39-kilometre long feeder canal that is derived from upstream of the barrage, and joins the sea about 500 kilometres downstream. In its tidal stretch, notably in Kolkata, the river is named Hugli River. The Damodar River joins the Hugli about sixty kilometres ahead of its confluence with the sea. The river finally merges with the Indian Ocean near Sagar Island, on the western side of the Sundarbans, a complex of mangrove-type coastal islands that is shared between India and Bangladesh. According to the Hindu cultural perspective, Sagar is the place where the Ganges River meets the sea and is therefore a site of pilgrimage and religious celebrations.

2.1.3 Climate and perspectives from climate change models

The climate of the Ganges River basin is dominated by the monsoon that refers to a seasonal shift in the wind direction that usually causes a considerable

change in temperature and precipitation, notably a transition from drier to wetter regimes. During the monsoon, from June to September-October, the southwest winds transport moisture from the northern Indian Ocean and drop it on the continent, providing intense rainfall. The winter winds (November to February) blow from the northeast regions of the Asian continent and travel towards the Indian Ocean. This annual cycle of atmospheric circulation arises from differential warming between the land and the sea, notably between the Tibetan plateau and the Bay of Bengal. This differential heating leads to development of convective cells and consequent moisture transport and deposition through rain, inland (Singhvi and Krishnan, 2014). The precipitation during July-September period represents 70 to 80% (sometimes up to 90%) of annual rainfall over the basin (Singh, 2007). The southwest monsoon becomes active in Bengal by early June and covers the entire Ganges basin by mid-July. The average annual rainfall varies from one region to another: Bengal witnesses about 160 cm, while western regions of the basin (Uttar Pradesh and Haryana) receive about 50 to 70 cm (Singh, 2007). From 100 to 250 cm of precipitation fall on the Ganges headwaters (Himalayan slopes) during the monsoon (Wohl, 2011).

Although the monsoonal circulation occurs every year, its strength varies: the all-India average monsoon rainfall has fluctuated around a mean average of 88 cm (for the period 1871-2011) by about 20-30% but without a pronounced long-term variation (Singhvi and Krishnan, 2014). The variability of amount, intensity and distribution of rain through a season in a given region is more significant. 20 to 30 % lower rainfall implies drought, or higher rainfall may imply floods.

Recent studies scrutinize the past trends of the Indian monsoon (see the review of Singhvi and Krishnan, 2014) and the potential effect of climate change in the future. Two trends seem to be witnessed today, as presented by Singhvi and Krishnan (2014): the weakening of the monsoon low-level southwestern wind flow and the increase of the frequency of extreme rainfall events, with less low or moderate monsoon rainfall days. Other phenomena are also reported, linked to the weakening of the monsoon winds: the reduction of the frequency of "monsoon depressions" that produce much rainfall and the increase of frequency and intensity of prolonged monsoon "breaks" over India. Some climate models establish the link between these phenomena and the global warming; others point instead to the increase of anthropogenic aerosols in the atmosphere.

The Intergovernmental Panel on Climate Change (IPCC) establishes hypotheses on future climate changes for South Asia in its Fifth report (IPCC, 2013). In most of South Asia region, global warming, in a low-CO_2 emissions scenario, would probably lead to: 1. average temperature rise (less than to 2°C by 2100 but maybe up to 3°C in higher latitudes), 2. ocean warming, mostly at surface, and ocean acidification, 3. increase of the frequency of hot days, 4. more frequent heavy rainfall days in some areas and more extreme rainfalls in cyclone-prone areas, 5. global mean sea-level rise of 26 to 55 cm compared to 1986-2005 levels. In a high-emission scenario, mean temperature rise could reach more than 2°C by 2050, as well as a rise of global mean sea-level up to 1m by 2100. All these phenomena will concur to increase riverine, coastal and urban floods (IPCC, 2013, 10).

Ellen Wohl (2011) also reports the consequence of air warming in the Himalayan regions where some sources and tributaries of the Ganges originate: the summer precipitation falls as rain rather than snow, accelerating the melting of the glaciers. She warns of two consequences of glacier melting: the meltwater fuels larger river flows and lakes form at the top of valleys because of dams created by huge moraines. When the meltwater overtops the moraines or seeps through the sediments, the moraines finally collapse and may cause destructive glacial lake outburst floods.

2.1.4 Hydrology

The Ganges, like the Brahmaputra, is a seasonal river, primary fuelled by monsoon rainfalls within the river basin. An hydrograph established by Rao (1979) at Farakka, ahead of the confluence with the Brahmaputra, shows a spectacular peak flow in July/August and a relative low level of discharge from November to end of June. During the 1949-1973 period, the average mean monthly flow in April is 1,751 m^3/s while the average mean monthly flow in August reaches 43,030 m^3/s (calculations with data from RIVDIS). According to Singh (2007), the maximum and minimum discharges at different monitoring stations on the Ganges may vary by a factor of 10 to 100. The changes in channel pattern also reflect the seasonal variation: the river becomes one single large channel in monsoon period but often revert to multiple braided channels in dry periods.

Meltwater and predominantly groundwater contribute significantly outside of the monsoon season. Estimations of the ice and snowmelt contributions to the total discharge of the Ganges at Farakka, though uncertain in absence of field data, tend to acknowledge a small contribution of 2 to 10% of ice and snowmelt in the total runoff, with potentially 40% from icemelt and 60% from snowmelt (Siderius et al. 2013; Alford and Armstrong, 2010; Immerzeel et al., 2010). Further results from models established for four Himalayan sub-catchments of the Ganges basin show a snowmelt contribution of about 1 to 5% of the total runoff (Siderius et al., 2013). In upstream reaches, these models estimate the annual average contributions of snowmelt to be between 10 and 30% to the river runoff (Siderius et al., 2013). However, during the months of March to May, snowmelt contributes in larger proportion to the river runoff, reaching 39% to 77% in headwater basins and remaining 12% to 38% at Farakka, depending of the model used (Siderius et al., 2013).

The groundwater contribution to river flows is important, as shown by Moore (1997) through its study of fluxes of radium and barium in the Ganges-Brahmaputra delta during low river discharges. Andermannn et al. (2012) provide an estimation of the subsurface contribution (transient groundwater) to annual river flows in Nepal. From three Nepalese catchments, the authors find that the volume of water flowing through fractured basement aquifer is about six times higher than the ice and snowmelt contribution to river discharge.

The annual discharge along the river shows a stepwise increment due to the contribution of major tributaries draining the different parts of the basin (GRBMP, 2015). In particular, the Yamuna flows are higher than the Ganges flows at their confluence in Prayagraj (formely Allahabad). According to recent model estimations of the respective contributions of the tributaries along the river, the predominance of Yamuna, Ghaghrak, Kosi and Gandarak tributaries in the Ganges runoff is explicit (GRBMP, 2013).

Water extraction affects the dynamics of the River Ganges discharges. The impact of water control or extraction structures in the Ganges basin on pre- or post-monsoon season runoff is high. As an illustration, a figure presented in the Ganga River Basin Management Plan extended summary 2015 reflects the decrease of the annual flow contributions of Ganges tributaries to the main stem, linked to the presence of water management structures that are mainly diversion

structures for irrigation (Figure 10, GRBMP 2015, 16). Figure 7 below presents the current presence of large water infrastructure and projects within the basin. Groundwater extraction in the Ganges basin plains also affects the river runoffs in dry seasons. Tubewell irrigation has largely increased during the last five decades; groundwater irrigation is now dominant in Uttar Pradesh or Uttarakhand states (about 73% of the net irrigated areas, MoWR, 2014). As much of the surface irrigation system is in poor condition, farmers individually developed tubewells that would be now more than 1,75 million units in the Ganges basin (World Bank, 2013). Some recent measurements show in the Ramganga sub-basin a two-fold decrease of the base flow toward the river in the period 2000-2010, due to increased groundwater pumping (Surinaidu et al., 2016).

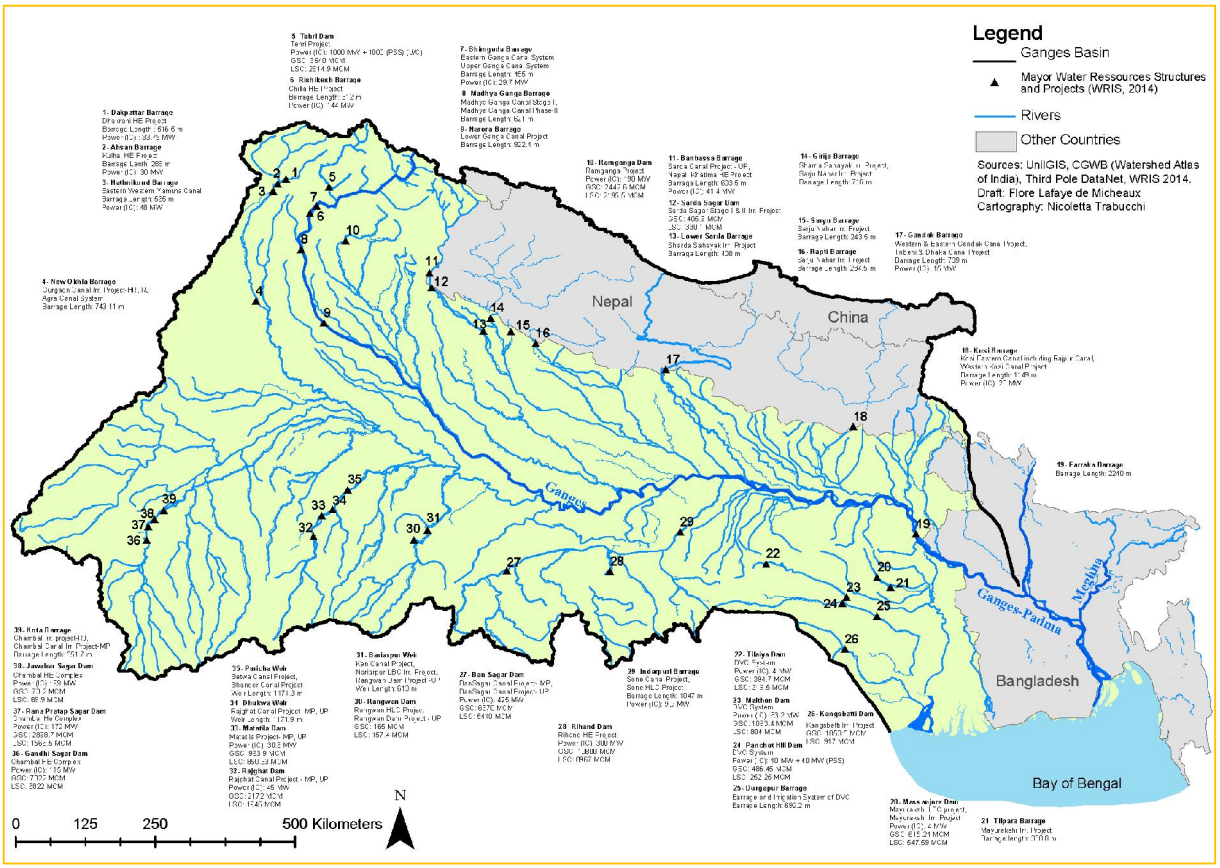


Figure 7: Major water resource infrastructure and projects in the Ganges River basin (adapted from WRIS, MoWR 2014, 74).

The impact of the extraction activities on river runoff is difficult to establish. Discharge data related to Ganges and Brahmaputra Rivers in India is classified in the name of national security. Institutions like the *Central Water Commission*

(CWC) or the State administrations do not publish the discharge data that they collect. There are however 318 active CWC hydro-observation stations in the Ganges basin. A few records are thus available: in the Global Runoff Data Centre (RIVDIS), runoff data is available in Farakka station only, and is limited to the 1949-1973 period (Global Runoff Data Centre or RIVDIS). The data produced by Rao (1979) is still mobilized in the literature (see for example Gupta, 2007; World Bank, 2013). Rao mentioned an average annual flow at Farakka of 459 billion m^3 ('measured', presumably from 1965 to 1975) while a recent model proposes a mean annual flow of 248 billion m^3 at the same Farakka station, for the 1969-2001 period (Jeuland et al., 2013) [24].

2.1.5 Geomorphology and sediment budget

The Ganges river basin comprises three distinct geomorphic provinces of the Indian subcontinent: the Indian Peninsula, the Himalayan Mountains and the Indus-Ganges-Brahmaputra Plains. The Indian Peninsula displays the oldest landforms dating from Gondwanaland. The Himalayan landscape and the foreland basin (like the Ganges-Brahmaputra Plains) formed and evolved during Neogene and Quaternary. For about 50 Million years, tectonic uplift, rapid valley incision, landslide erosion and glacial erosion have been responsible for the relief of the Himalayan landscape. The fluvial systems of the Ganges have progressively settled and evolved during the Quarternary, with the combined processes of the onset of monsoon climate over the subcontinent (about 10 Million years ago), tectonic movements and successions of climate changes (glaciation, wetter or dryer periods). Alluvial plains, river terraces and deltas have been shaped due to resulting aggradation or degradation processes (Kale, 2014).

The Ganges-Brahmaputra river system presents a sediment yield of about 1000 million tonnes per annum in Bangladesh at about 200 kilometres from the Bengal Sea. It also represents the second highest suspended load of any river system in the world (Gupta, 2007). 80% of the sediment that travels all the way downstream to the Bay of Bengal originates from rocks in High Himalaya, further

[24] Jeuland et al. (2013) present findings derived from a SWAT model using meteorological data from Climate Research Unit, University of East Anglia, as mentioned in the note of the Figure 1, page 28 and page 33. However the gauge stations for calibration were only available in Nepal and Bangladesh. There is a mention of "historical measured river flows" in page 28 but with no further precision elsewhere.

to glacier outwash, landslides and diverse erosion processes (Wasson, 2003). Estimations indicate an erosion rate of about 25 mm per annum, happening in overall High Himalayan landscapes (Wohl, 2011). Further erosion also happens in the foothills slopes of the mountains (Lesser Himalaya and Siwaliks) and in the plain itself. 45% of the sediments are deposited in the subaqueous delta and in the large submarine Bengal Fan (about 16,5 kilometre-thick according to Wasson, 2003). The remaining sediment is transported as bedload and deposited on tributary fans, on the floodplains and on the subaerial part of BGM delta. Current processes of accumulation of bedload in channels are witnessed in some areas of the Gangetic Plain but without proper estimation of aggradation rate (Wassson, 2003). Wohl (2011) evokes the disruptions caused by river engineering on siltation/erosion and flooding processes.

The Gangetic Plain is a vast alluvial plain of low relief (less than 200-300 meters), covering about 250 000 km^2 or 25 million hectares. It consists of two alluvial deposits named *Bangar* (old) and *Khadar* (recent). The former represents more clayey and calcareous alluvium. It forms high, extensive terraces or interfluves while the younger and lower alluvial deposits are confined to the modern floodplains of the Ganges and its tributaries. The width extension of the Gangetic Plain (*Bangar* and *Khadar*) is about 10-30 kilometres large, while the valley with the active channel (*Khadar*) represents a width of about 5-20 kilometres with main channel and active floodplains extending on 0,5-3 kilometres in width (Singh, 2007). They store one of the largest aquifers in India, with high rates of groundwater recharge thanks to the monsoon precipitations and flows. For the last 4000 years, the Ganges main channel is mainly a meandering river, like the Yamuna (Wohl, 2011).

The dynamicity of the Ganges river system remains high, due to the considerable inter-seasonal and inter-annual variations of water and sediment flows. Until now, the Ganges and its tributaries migrate more or less freely across the floodplains, leaving abandoned channels as shown by Rudra (2014) over the last centuries and decades in the lower Ganges basin. More predominant are the localized and annual readjustments of channel sand and silted bars (locally termed *chars*) after high flows, with changes in their shape, size and location. Conversion of braid bars into lateral bars attached to one of the banks, then again eroded, frequently occurs (Singh, 2007). Anthropogenic structures like dams, barrages, road or rail

infrastructure and embankments tend to fix some channels or to modify flood extensions. However, floods, in worst years, may reach 16 million hectares in the overall basin, mainly in Bihar and Uttar Pradesh states (Wasson, 2003 citing CSE, 1991) with dramatic social and economic consequences. The above-mentioned infrastructure then often got damaged or flooded. Some studies showed how embankments and other fixed structures contributed to worsen flood issues in the basin (CSE, 1991; Mishra, 1997, 2008).

2.1.6 Water and sediment quality

The foremost perceptible pollution of the river is organic and bacterial. The main source of the organic charge is the wastewater produced in the basin housing more than 400 million people (it is the most populated river basin in the world). Only 4,000 out of 12,000 million litres per day (mld) of wastewater produced within the Ganges basin are currently treated (NMCG website). About 3,000 mld of sewage is discharged in the River main stem from the main cities along the river banks, with only 1,000 mld being treated[25]. The non-treated effluents then directly flow to surface waters through drains. Additional contributions from industrial pollution sources represents about 20% more in volume, with greater presence of chemical and metallic contaminants (NMCG website).

Bacterial pollution is severe: many stretches of the Ganges channel in Uttar Pradesh and in Bihar do not meet World Health Organization's bathing standards, though regular bathing activities do take place all along the river for religious purposes, as well as drinking use (CPCB, 2013). Other religious activities like cremation on the banks of rivers or offerings also add organic and bacterial load to water quality, without a clear assessment on their proportion in the overall pollution load. Presumably more significant in this regard are the untreated commercial and industrial effluents.

Toxic substances are also widely used and released to surface waters in the basin. Industrial effluents represent huge sources of contaminants to the river water and sediment, like heavy metals (lead, mercury, copper, chrome, zinc, cadmium, et.), chlorine, HAP and PCBs. Studies showed how Yamuna river sediments

[25] These figures relate to Tier-1 and Tier-2 cities only, which present populations that are above 50,000 residents.

present high levels of metal contamination derived from Delhi and Agra cities situated on the bank of the River (Singh, 2001, Laxmi et al. 2015) or high levels of organotin contaminants in the Ganges, linked to Kanpur industrial area (Ansari et al., 1998). Actions of malaria control also make use of DDT that is found in high levels in Gangetic dolphins' tissues (Kannan et al., 1993).

Agriculture is an important source of nutrients (phosphorus and other chemical fertilizers) and pesticides to water bodies. The increase of such inputs in agricultural practices since the 1950's has been considerable. In Uttar Pradesh State alone, that is entirely situated in the Gangetic Plain, the amount of pesticides used in 2007-2008 reached about 5100 tonnes per year and the amount of chemical fertilizers, about 3,8 million tonnes per year (source: GRBMP report 49, IITs, 2011). As of now, these contaminants are not monitored in a regular routine by Indian nor Bangladesh authorities, but some studies have traced some of these molecule residues in surface waters as well as in connected groundwater (Agarwal et al., 2015*).*

Finally, alteration of groundwater quality is also linked to the above-mentioned hydrologic, geomorphic and human-induced processes in the basin. Saline water intrusion in the delta region is of high concern for the coastal populations who seek to access potable water (Wohl, 2011, 344). This phenomenon is aggravated by the reducing fresh flows of the rivers in non-monsoon seasons. High level of arsenic in groundwater in the delta and in other states of northern India is of geologic origin (Himalayan origin sediment), but studies tend to prove the impact of increased use of phosphorus fertilizers in triggering arsenic solubility (Signes-Pastor et al., 2007).

In conclusion, the picture of Ganges' quality and quantity issues is particularly grim, as it is often the case for Indian rivers (Iyer, 2015). Despite the river's huge dilution capacity, several stretches of the Ganges are polluted even in post-monsoon season (CPCB, 2013; CSE, 2014). The Ganga Action Plans were not sufficient to curb the pollution trend. The situation has worsened due to the coupled effects of demographic expansion and of the increase of water extractions from groundwater and surface waters. However, the exact evolution and present magnitude of the pollution and of water quantity problems are not assessed. Several data gaps, the central one being the hydrological and sediment components, impair the ability of researchers and administrations to

adequately address the dynamic issues of water availability and quality. The social and ecological consequences of this situation, such as the evolution of related threats on human health and on ecosystem health are thus little assessed too[26].

2.2 River Ganga in Indian sacred geography

In the previous section, my aim was to present the tangible Ganges Basin's landscape, as well as the river-related issues that are captured through natural science and river management lenses. In line with the hydrosocial approach that seeks to capture the 'experiential, cultural and metaphorical ways' of connecting to water (Linton and Budds, 2014, 174), I wish here to introduce some of the significant cultural and metaphoric dimensions of the river in the Indian context, from a literature review. These dimensions largely permeate the political, social and economic spheres today, as the following chapters will highlight. I will first present the specificities of an Indian 'sacred geography' (Singh, 2011; Eck, 2012) in which the Ganges River is one element, then some insights on traditional reverence to sacred waters. The particular myths and religious practices related to the Ganges will be presented too (Rosu, 1999; Darian, 2001; Eck, 2012; Drew, 2017).

2.2.1 Indian sacred geography and the rhetoric of a motherland

Diana Eck, an American geographer, dedicated more than twenty-five years to studying pilgrimage places in India as well as related practices and religious scriptures. In 2012, she published 'India, a sacred geography', a book that both theorizes and closely describes the richness of the Indian 'imagined landscape'. She points to the resonance of the geography in India that is not merely made of rivers, mountains, hills or coastlands, but that is 'charged with stories of gods

[26] There is a growing number of studies that are related to freshwater ecosystems and biodiversity. The IIT consortium in charge of preparing the River Ganga Basin Management Plan published 11 reports in 2011 and 2012 on 'floral and fauna diversity' of different stretches of the Ganges River, and some of its tributaries, as well as on status on fish and fisheries (GRBMP reports, IITs, 2011, 2012). Organisations such as Wildlife Institute of India, Wildlife World Fund India, International Union for Conservation of Nature had also developed biodiversity or specie survey studies. However, knowledge remains fragmented.

and heroes' (2012, 11). Eck refers to the sacred scriptures such as the early *Vedas* and the *Upanishads*, as well as to the myths and legends to be found in the *Mahabharata* and in the popular literature of the *Puranas*. She also largely studied the *mahatmyas*, a large body of Sanskrit hymns that are dedicated to praising the '*tirthas*' or pilgrimage places, and describing their benefits.

The '*tirthas*' litteraly mean 'fords' or 'crossings' in the sense of 'to cross over'. They were initially to be found on riverbanks or at the confluence of rivers, and they were a place to ford the river (Eck, 2012). However, the broad meaning of '*tirtha*' is related to a spiritual 'crossing'. In the Upanishads, it refers to a spiritual transformation of the soul that crosses from this world to the Supreme divine realm (ibid). Pilgrimages or *tirthayatra*s also played the role of substitute for expensive and elaborate Vedic ritual sacrifices. Today, pilgrimage may be undertaken to fulfil a vow, to seek spiritual purification or simply to experience the power of the place (Eck, 2012; Shinde, 2012). The most powerful places attract pilgrims from the whole country, across regions and beliefs. Long journeys, generally on bus, train but also on foot, often require giving up the comfort of a home for road risks and privations. There are also multiple local 'tirthas' such as particular temples that are visited by people from the immediate vicinity. According to Eck, 'India is a land of ten thousand '*tirthas*', and on any given day, literally millions of pilgrims are on the road' (2012, 10). In his case study of Vrindavan, a pilgrimage site associated with Krishna worship next to Yamuna River, Shinde (2012) for instance showed the magnitude of the increase in number of pilgrims, from 5,000 annual visitors in 1950 to more than six million in 2005, in relation to the recent development of a religious tourism marked by 'free-market' processes.

Eck also highlights, following other authors such as the Sanskrit scholar K.V. Rangaswami Aiyangar who wrote in the 1940's, that the dense and sophisticated network of pilgrimage places in India –often pluricentric and duplicated in various parts of the country- has constructed a sense of Indian 'nationhood', as a shared and living landscape. For Eck, 'this "imagined landscape" has been constituted not by priests and their literature, but by countless millions of pilgrims who have generated a powerful sense of land, location, and belonging through journeys to the hearts' destinations' (2012, 5). Rana B. Singh also points to the 'cosmic web' that connects these places 'where orderdness and wholeness meet' (Singh, 2011,

27). Humans attempt there to realise one's identity in the cosmos. Singh underlines therefore that 'rituals and rites constantly [repeat, revive, regulate and rejuvenate] the cosmic order of sacred territory' (2011, 27).

In this context, the Hindu nationalist movement that emerged in the nineteenth century could mobilize the strong and popular sentiments of belonging to that sacred landscape. Eck stresses their antiquity: 'For those in the loose family that might be called « Hindu », the three-dimensional mental map of Bharata [India] had long-accumulated rhetorical and ritual meanings, some of which were by now twenty-five hundred years old' (2012, 94). She shows how the rhetoric of the motherland developed since the late nineteenth century among some Indian authors, with the expression of a religious reverence to a spiritual Mother who is more than just a 'mother country'. Hindu nationalist proponents then often mobilized the dual image of a map and of a Goddess in political contexts, such as in the following text of a Rashtriya Svayamsevak Sangh (RSS)'s pamphlet in 2004:

'*I am India. The Indian nation is my body. Kanyakumari is my foot and the Himalayas my head. The Ganges flows from my thighs. My left leg is the Coromandal Coast, my right is the Coast of Malabar. I am this entire land. East and West are my arms. How wondrous is my form! When I walk I sense all India moves with me. When I speak, India speaks with me. I am India. I am Truth, I am God, I am Beauty'.* (S. Jha, 2004 cited by Eck, 2012, 102).

2.2.2 Sacred waters and the Ganges River

Traditions of reverence to the water element are also strongly connected to religious interpretations and daily practice towards the Ganges River. Arion Rosu, a renown francophone Indianist, produced in 2000 a detailed study of water 'in life and thought of India' based on the Sanskrit literature and some of his observations (Rosu, 1999). His work attests of the ancient glorification of waters, as water is the source of life for every living creature. A text from the Upanishads correlates waters with the whole universe: 'waters are the whole universe, the beings, the breaths, the livestock, the food, etc.' (MNU 7.312-316 translated by Rosu, 1999, 35). Rosu also accounts for the wealth of ancient water studies, which notably classified in fine details the organoleptic and

medical properties of waters, according to their meteorological or geographical sources. Gangetic waters were praised for their qualities, as they were said to be 'touched' by the wind, the sun and the moon. They were also said to be of divine origin. As in other antique civilizations, the medical properties of waters –or their contribution to a plentiful life according to Aryuvedic principles, were related to religious practices and cosmological meanings (Rosu, 1999). In addition, the use of water as a purifying element, materially as well as ritually, is attested since the Vedas (Rosu, 1999). Ablutions, mouth and body cleansing or manipulations of water, notably among casts for water transportation for instance[27], were strictly codified. Water was a key resource for religious purification and practices, and shrines were often chosen in the vicinity of water bodies or sources. In this regard, rivers were particularly useful: they provided sufficient water for several rituals, like the funeral ones. Their continuous flows offered waters that did not require to be treated, in contrast to many stagnant waters[28].

Reverence to rivers is attested since the Rig-Veda. All rivers are considered holy in the Indian context. Seven large rivers such as the Ganges, Yamuna, Godavari, Sarasvati[29], Narmada, Sindhu and Kaveri are particularly revered. However, the Ganges became prominent in the Brahmanic mythology (Rosu, 1999) and it is now the supreme symbol of Indian sacred rivers. Diana Eck reports that 'every wave' of the Ganges River is said to be a '*tirtha*' (Eck, 2012, 160). The Ganges is also said to be the source of all sacred waters in India. As an illustration of the duplication principle mentioned by Eck about Indian sacred geography, more than 150 rivers and tributaries are mentioned in the Puranas with the following conclusion: 'All these rivers are holy; all are Gangas that run to the sea; all are mothers of the world; and all are known to be destroyers of the world's sins.' (Markandeya Purana, 57.31 cited by Eck, 2012, 126).

The Ganges River is revered as *Ganga Devi* or *Ganga Mata* (Mother Ganges), a Goddess of mercy and compassion, who purifies sins (Alley, 2000; Eck, 2012). According to epics and myths, such as in the *Ramayana*, the Goddess Ganga

[27] Water was a marker of the socio-religious hierarchy (Malamoud, 1995 cited by Rosu, 1999).

[28] Traditional water treatments for potability are attested by Arion Rosu in his study. They were multiple and elaborate (Rosu, 1999).

[29] This river does no longer flow and became an 'imagined river', that is said to meet with Yamuna and Ganges rivers in Prayagraj, Uttar Pradesh. Other propositions replace the Sarasvati with the Krishna River in this list (Eck, 2002, 511).

descended on earth (*gangavatara*) from heaven (Rosu, 1999). The myth relates the human intervention of King Bhagirathi who spent years of penance and ascetic practice to obtain the favor of the gods, that is the Goddess Ganga's descent on earth, in order to purify the ashes of his 60,000 ancestors. The river is said to have flowed through Shiva's hairlocks, who helped to prevent the Goddess to destroy the earth with its force, before reaching the earth in the Himalaya at Gangotri (Darian, 2001; Eck, 2012). Several *tirthas* along the course of the River are of particular importance: in the Himalaya, the glacier-source named Gaumukh and the village of Gangotri in the Bhagirathi valley, as well as many shrines and five '*Prayags*' (or confluences) in the Alaknanda valley, the other headsource of the Ganges; cities such as Uttarkashi, Haridwar 'the gate of the Ganga' supposedly opened by King Bhagirathi in the mountain range, from which the river flows in plains, and further Prayagraj[30], the holy confluence of rivers Yamuna and Ganges; the city of Varanasi, or Kashi, where intense rituals are performed, notably to the dead for them to reach liberation from eternal rebirths, and finally, Sagar, the place where the river meets the Bengal sea. There stands the Kapila temple, Kapila being the name of the ascetic who destroyed the 60,000 princes mentioned in the story above – and who finally forgave them.

Beyond localized sacred sites, the very water of the Ganges (*Ganga jal*) is also worshiped as a highly purifying element. Its exceptional self-purifying and non-decaying properties are traditionally reported; these properties were the object of several debates and studies, one of them recently supported by the central Ministry of Water Resources. Contemporary Hindu rituals and ceremonies are performed with Ganges waters at the riverbanks as well as at far distances, at local temples or at home, all over India (Rosu, 1999; Eck, 2012). Thus reverence of the river is not only performed by valley residents or pilgrims, but by any river devotees across the country. In her study, Eck highlights the duplication of the name 'Ganga' to many local rivers. She also mentions that virtually every temple tank in south India is referred to as *Shiva Ganga* and is supposed to be connected underground to the Ganges river in north India (2012, 159).

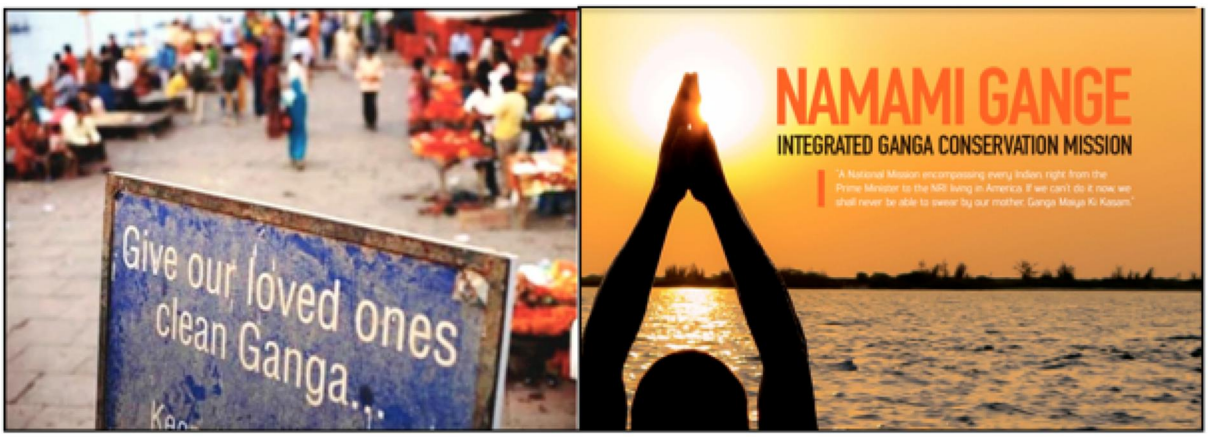
[30] The city was renamed by the BJP-led State government in October 2018. The city's name was previously Allahabad.

Finally, the bodily interactions with the river are also central in this human-river relation. Many rituals involve bathing and ablutions with the Ganges water, or even taking a sip. Haberman recalls that the relations to the material river are a condition for the two more elevated stages of the spiritual river and the Goddess River to operate, as developed by Vallabhacarya, a sixteenth century Hindu saint (Haberman, 2000). Reciting mantras and 'uttering' the name of Ganga play an important role in the Hindu faith. They are also a way to invoke the Goddess' presence in rituals at home (Eck, 2012). Anthropologist Georgina Drew showed in her study in the Bhagirathi valley how contemporary devotees in Uttarkashi city, especially women, mobilize chants dedicated to the river to actualize and strengthen the human-river relation (Drew, 2017).

These rituals strongly connect devotees to the river and contribute to shape it as a socio-nature, both materially [31] and discursively. In this chapter, I demonstrated how the same river can either be interpreted through scientific knowledge as, for instance, a group of measurable features (sediment budget, water flows, length of the river course, size of the floodplains, etc.), or through a religious perspective that closely relates mythical narratives to the river and that entails specific ritual interactions with the river, performed by millions of devotees. This observation led me to reflect further on 'what is a river'. This question emerged as a requisite step for conceptually investigating the hydrosocial framework in river contexts (sub-questions B1 and B2). Before addressing this theoretical question in Chapter Four, I will investigate in the next chapter the historical emergence of a 'Ganges problem' and the characteristics of the contemporary *Namami Gange programme*, in order to address the research sub-questions A1 and A2.

[31] For instance, in addition to his Vrindavan case, Shinde cites a body of literature that shows how pilgrimages may lead to environmental degradation (2012, 117).

CHAPTER 3 – WHY 'REJUVENATING' THE GANGES? THE EMERGENCE OF A GANGES RIVER PROBLEM



The previous chapter touched on the scientific description and cultural interpretations of the Ganges River. The present chapter turns the focus on the historical trajectory of public interventions and governance processes around the river, during the last forty years. The aim is to clarify the referential shift brought by the *Namami Gange programme* led by Narendra Modi government since 2014, following the conceptualization of Muller (2013). As the referential concept refers to the cognitive (what is it about?) and prescriptive (what does it require?) dimensions of an object of public policy, I wish to develop the history of how rivers, and particularly the Ganges, have been managed within Indian legislation and programmes. Taking a step back, and following McElwee, the broader question that needs to be addressed is to decipher the ways through which the 'Ganges' problem' has been identified and made visible. As pointed out by several authors (notably Dean, 1999; McElwee, 2016), such a problematization is a process that is not self-evident.

McElwee elaborates, in citing Miller and Rose, 2009:

'We need to understand which questions rise to the point of being defined as in need of a solution, while other issues of concern may be never characterized as a problem at all' (2016, 16)

McElwee seeks to clarify processes of 'environmental rule', or in her terms, the 'underlying improvements to people and societies' in the name of the improvement and the protection of the environment (2016, 4). She thus reflects on the emergence of environmental 'problems' that trigger such environmental rule. McElwee highlights in the context of Vietnamese forests that this process *'[…] requires three things: nature must be defined as an object of intervention, often in ways […] which are glossed over as universal, 'scientific', or common-sense; these environments to be intervened must be visualized, usually through the production and circulation of maps establishing authority; and processes of change in these environments must be named, as in directing attention to 'deforestation' while other changes are ignored. These practices taken together set the stage for later detailed interventions in conduct'.* (2016, 17)

In this chapter, I will study these three dimensions in relation to the 'Ganges problem'. I do not focus specifically on either the 'pollution problem' or the 'degradation problem', as I will show that these characterizations of the 'Ganges problem' have evolved over the last forty years. This deeper understanding of the dynamics of the 'Ganges problem' will help to analyse the recent referential shift, in a second step.

3.1. How has the River Ganges been defined as an object of public intervention?

3.1.1 Historical interventions on river uses

One could say that rivers have been for long an object of public intervention in India. There is evidence of irrigation projects and dams on rivers that were implemented during the Mauryan empire, about 300-200 BC (Gadgil and Guha, 1992). The *Arthashastra*[32] by Kaulya (about 300 BC) also mentions this device as a mean for authorities to get financial returns. What was targeted at that time

[32] A 'manual of the art of government' often compared to the political treaty of Machiavel, 'The Prince' (1532).

was not the river per se, but the productivity of agriculture through the use of water. During the Mughal empires, centralized powers also ruled other economic river uses, like inland navigation and trade. Fisheries were an exception. Apart from some few feudal 'fishing rights' or the attempts of taxing fisheries by some Mughal rulers, fishing activities on rivers were mostly controlled by belief systems and social conventions among fisher communities (Gadgil and Guha, 1992). Later, the British colonizers created dedicated administrations for navigation and irrigation. They largely exploited the navigability of the Ganges River in its lower stretches for transportation and trade, in relation to the Port of Calcutta, the capital of the Indian empire until 1911. They also widely developed irrigation canals, in the frame of a 'colonial hydrology' that aimed at maximizing revenue collection for the British Raj with major incidences on waterscapes and livelihoods (D'Souza, 2006).

As usually reported, the foreign rulers (Mughal rulers then British ones) did not intervene in the religious uses of the rivers. Nevertheless, an episode mentioned by Kelly Alley (2000) shows that the access to the Ganges River for rituals became punctually an object of concern for the colonial authorities, as a major stampede among Hindu pilgrims occurred in Haridwar in 1819, where 430 victims, including British *sepoys* (Indian soldiers), perished. In reaction, the British administration expanded the access way to the *Har-ki-Pauri ghat*, the most sacred place along the river of the city, as well as the *ghat* itself (Alley, 2000).

3.1.2 A case of river politicization

In the context of the emergence of nationalist movements, a century later, another episode in Haridwar illustrates how an initial 'problem' of local access to the river triggered a far different political process. The following episode is particularly noteworthy as it illustrates two trends that will grow further along the twentieth century in India: on one side, the increasing importance of the river control paradigm that will definitively define rivers as an object of public intervention (Lahiri-Dutt, 2000; Baghel, 2014); on the other side, the particular trajectory of the Ganges river among other Indian rivers within political debates and public action, in relation to nationalist agendas.

In that case, documented by Kelly Alley (2000), the British engineers of the Irrigation Department of the United Provinces planned in 1909 to modify flows in the various channels of the Ganges at Haridwar, through masonry works. A dam, a regulator with gates and the creation of a new channel were planned. These channels were all related to the Ganges Canal that they had built and operated since 1855. Their aim was to reduce maintenance works. British administration promoted the release of more water in the channel passing along *Har-ki-Pauri ghat* as a justification of the project. Kelly Alley narrates that this solution satisfied the local priests. However, as early as 1909, a Hindu nationalist unity, the *All-India Hindu Sabha*, led by a Brahmin priest, Madan Mohan Malaviya, protested against that project, arguing that the river's flow needed to be unobstructed for bathers. The reaction of the British government was first to ignore the protest. In 1914-16, the agitation among the Hindu community gained political importance. Alliances were forged with leading Indian public figures in the country (maharajas, magistrates, etc.) and the matter was then handled by the lieutenant governor of the United Provinces, in relation with the national Government. The conflict finally ended in an agreement of December 1916 – definitively recognized in September 1917- that fully satisfied the mobilized Hindu community, at the expenses of the Irrigation Department's projects.

In this process, the alliance of nationalist and religious figures operated a twin move. They managed to replace, in the public decision, the cognitive representation of the river as merely a localized bathing place, with an understanding of the river as a sacred entity whose flow had to remain unobstructed; they also instrumentalized the river for political ends. This move presented a political threat, according to the British Chief Secretary, Government of the United Provinces, as he expressed it in a 1917 letter to Home department in India:

'It is necessary to face the fact that Hindu sentiment was not consulted before these works were determined on, that it is extraordinarily powerful in all matters concerning the sacred stream at Haridwar and that the agitation –engineered and dishonest though much of it is- has penetrated and if unchecked will further penetrate vast depths of Hindu sentiment, which it would be most inexpedient to array against Government at any time and more especially at present' (in Parmanand, 1985, 250 cited by Alley, 2002, 365).

3.1.3 The river control paradigm in India since 1947

In his genealogy of the river interventions in India and South Asia, Baghel (2014) remarkably puts forth the various underpinning aspects of the river control paradigm that made it hegemonic in India since the Independence. Such 'Hydraulic Mission', as coined by Molle et al. (2009), refers to the emergence in the twentieth century of massive irrigation and hydropower projects worldwide, led by nation-states[33]. These projects were systematically implemented by newly formed 'hydraulic bureaucraties'. Molle et al. attribute this international move to several concomitant factors: the seduction of overarching ideas, notably a worldwide enthusiasm for 'scientific irrigation', the associated view of the domination of nature but also the 'biblical/messianic overtone of the call for creating new Edens in deserts or arid places' (2009, 333); the technological innovations in hydropower and irrigation domains; finally, the thirst for iconic symbols of state power, modernity and development, either in 'first' and 'third' worlds.

Baghel adds to this analysis some more contextualized elements related to South Asia and India in particular. I select here two of the main arguments. First, Baghel stresses the sense of urgency to fulfil the potential of the nation, shared among newly independent governments. Second, he mentions the enduring effect of colonizers' perspectives on India, like the idea of a 'tropical nature' -that also encompasses an alleged 'passivity' and 'backwardness' of its inhabitants, to be corrected. Baghel also refers to the famous quote of Prime Minister Jawaharlal Nehru about dams as 'modern temples of India', which expressed a wish of a 'move away from sacred river, to dams as temples, in order to create a "modern" India'. Indeed, Nehru tended to link religion, superstition and 'backwardness' (Baghel, 2014, 72).

Therefore, in order to fight poverty and 'backwardness', the envisaged way was to transform the country's geography [34] and to import external scientific

[33] The authors however stress the idea that some of the roots of the Hydraulic Mission took place in the 19th century in colonies where 'colonial powers could mobilize massive corvée labour and the technical and scientific knowledge of enthusiastic engineers' (Molle et al., 2009, 329).

[34] According to Baghel, the post-independence authorities obviously dropped the racist underpinning of the idea of a 'tropical nature'; the geographical determinist vision behind that idea was however kept (Baghel, 2014).

knowledge and models, like the famous American model of the Tennessee Vallee Authority. The latter notably inspired the creation of the Damodar Valley Corporation, a river development project and one of the first decisions taken by the Indian Parliament after Independence (Baghel, 2014).

A second implicit aspect of this 'governing paradigm' was also that the national, central level should direct initiatives and actions. The common view was that only this administrative level was able to conduct 'scientifically robust' approach. The case of the Planning Commission, a powerful central institution in India from 1950 to 2014 in charge of national development planning, illustrates this approach. According to Gadgil and Guha, a growing centralisation of power happened since the Indian constitution in 1948 and led to an increased weakness of state-level political institutions (Gadgil and Guha, 1992). They further argue that alliances of national-level politicians, government officials, bureaucracy and economic interests even 'sabotaged' attempts to build or strengthen decentralized political institutions (Gadgil and Guha, 1992, 42). The direct consequence of the hegemonic 'river control' paradigm in India was therefore the construction of more than 5,000 large dams over the 1950-2010 period and of about 34,000 linear kilometres of embankments. More importantly for governance processes, it also led to the creation of 'nationalized environments' where ecological differentiation is negated and where solutions seem easily replicable[35] (Baghel and Nüsser, 2010; Baghel, 2014). I will explore further this notion in Section 3.3.3 in relation to the recent Ganges national policy.

3.1.4 The Ganges, a specific object of national scrutiny

During most of the twentieth century, the Ganges River was no exception in the national move of dam-building and canal/embankment construction. In the whole Ganges basin, 158 large dams and 66 barrages were constructed; five of these barrages are positioned on the main stream with length varying from 312 meters (Rishikesh barrage in Uttarakhand) to 2,240 meters (Farraka barrage in West-Bengal) (MoWR, 2014). They feed major irrigation canals and the Hoogly River.

[35] This is even more explicit in the case of the 'Inter-Linking Rivers' scheme that aims to transfer water from water-rich regions to water-deprived regions through huge infrastructure projects. The current scheme that is publicized by the Narendra Modi government since 2014 relaunches previous projects that have been studied since the late 70's (Planning Commission, 1981).

The Central Electricity Authority estimated in the 1980's the economic potential of hydropower in the Ganges basin to be around 10,700 MW (NIH, 2018)[36]. Major hydropower projects (27) were then built in the Ganges basin, notably in the headwaters of the Ganges, the Bhagirathi and Alaknanda valleys. This programme is still being implemented. In these two river basins, eleven projects of over 25 MW are commissioned (among them, the Tehri dam, 1,000 MW) or under construction, and fourteen more projects of over 100 MW are planned (CSE, 2014).

Flood and inland navigation were also handled at the Central level, as the River has an Inter-State status. The Ganga Flood Control Board (GFCB) was set up in 1972 by the Central Ministry of Irrigation and Power. Recognizing floods as an annual feature and stressing the 'large scale damage due to floods that often occurs', the 1972 resolution established a special framework to coordinate inter-state efforts to 'tackle the flood, erosion and drainage problem in the basin' (Central Ministry of Irrigations and Power, 1972). The attention of the authorities was notably drawn to the cases of the Kosi and Gandrak rivers, and to the increase of floods in the Bihar and upper Bengal Gangetic plains, where the numerous road and rail routes had been built without consideration for drainage issues (Mishra, 2008)[37].

The Ganges River was the first water body to be declared 'National Waterway', in the Allahabad-Haldia stretch[38], in 1982, 'to provide for the regulation and development of that river for purposes of shipping and navigation' (1982 Act). Then in 1985 only, the Inland Waterways Authority of India was set up. The priority conferred to the Ganges can be related to the conclusions of the National Transport Policy Committee in 1981:

Inland water transport continues to be functionally important in regions in which it enjoys natural advantages, as on the Brahmaputra and the Ganga in eastern and north eastern regions of India, Kerala, Goa and in the deltas of Krishna and Godavari (Planning Commission, 1981, Sixth Plan, 17.64).

[36] It was however much less than the then estimated potential of the Brahmaputra basin (34,000 MW).

[37] A similar body for the Brahmaputra, the Brahmaputra Board, was set up few years later, in 1980. For other river basins, no such board was put in place.

[38] Haldia is the second dock complex operated by the Kolkata Port Trust. It is situated at the confluence of the Hoogly and Haldi rivers, downstream of Kolkata Port.

The Sixth Five-year Plan reaffirmed the launch of such 'specific schemes of inter-State and national importance for development under the Central Sector' (Planning Commission, 1981, 6th Plan, 17.65).

As a conclusion, this section showed that public interventions on the Ganges until the 1980's mainly problematized the river as a national resource to be harnessed for agriculture, navigation and energy uses, in similar ways as for other large and inter-state rivers and with a predominant role of central authorities. The next section will show how the identification of the Ganges as a national object of public intervention got enlarged with the river pollution problem.

3.2. HOW WAS THE 'GANGES PROBLEM' MADE VISIBLE?

This section will show how the river pollution problem, initially made visible in relation to a broader environmental awareness, got singularised around the Ganges and later strategically transformed (Section 3.3).

3.2.1 The gradual emergence of a river pollution problem

River pollution issues gradually emerged in India within a broader awareness about the environment. The recognition by the Indian authorities of the 'environment' as an object of public intervention can be traced back to the Planning Commission's fourth 5-Year Plan, in the year 1969 (Planning Commission, 1969; also cited by CSE, 1982):

'Planning for harmonious development recognises the unity of nature and man. Such planning is possible only on the basis of a comprehensive appraisal of environmental issues. […] It is necessary, therefore, to introduce the environmental aspect into our planning and development'.

The development of such environmental considerations was aligned with discussions within international arenas, such as, for instance, the 1972 Stockholm conference of the United Nations on the Human Environment. However, in this conference, Prime Minister Indira Gandhi particularly articulated environmental issues with questions of poverty, social development and global inequalities, with her expression 'Are not poverty and need the greatest polluters?' or the following sentence, reported by the New York Times:

"…how can we speak to those who live in villages and in slums about keeping the oceans, the rivers and the air clean, when their own lives are contaminated at the source?" (New York Times, June 26, 1972 cited by Ramesh, 2017)

This statement was followed by the creation in 1972 of the National Committee on Environmental Planning and Coordination (NCEPC), which received the mandate to do 'environmental appraisal of projects from selected sectors, surveys of wetlands and aquatic weeds, human settlement planning and spread of environmental awareness' (Planning Commission, 1981). Under the impulsion of the NCEPC, several environmental laws were however enacted in relation to protection of natural resources like soil, water and air[39]. A separate Department of Environment (DOE) was also created in 1980 that was notably administratively responsible for the 'pollution monitoring and regulation' domain. This central legislation was preceded by some state initiatives, like in Uttar Pradesh (an Effluent Control Board was set up in 1955) and in Maharashtra, which parliament adopted a Water Pollution Control Act in 1970 (CSE, 1982).

Social protests and strikes in various parts of the country to denounce river pollution accidents largely contributed to crystallize[40] the river pollution problem (Gadgil and Guha, 1992; CSE, 1982). In a classical move of co-production of science and social order (Bouleau, 2014), the water pollution problem then got generalized and stabilized by the production of pollution assessments and establishment of water quality standards in rivers. The pollution scandals in the 1960's and 1970's triggered research interest and the launch of projects by national research institutes or by Indian universities[41] (CSE, 1982); reversely, these assessments contributed to further pinpoint the pollution problem to authorities, which thus produced water quality standards. Finally, with those

[39] Such as the Insecticides Act, 1968, Wild Life Protection Act 1972, the Water (Prevention and Control of Pollution) Act 1974, the Water Pollution Cess Act, 1978 and the Air Pollution Act, 1981. Some of these acts made explicit reference to the commitments taken at the Stockholm conference.

[40] I use this term in reference to Gabrielle Bouleau's classification of the political works around an environmental motive (or a perceived representation of an environmental problem, in my reformulation) (Bouleau, 2018). In her term, 'crystallization' refers to a 'singularization' of such a motive or the publicizing of its singularity. She distinguishes this political work from a 'politization' of a motive that operates through 'generalization' (2018, 44).

[41] In 1982 however, data or detailed reports on peninsular rivers, like the Narmada, the Godavari, the Kauveri or the Krishna, remained scanty (CSE, 1982).

standards, the problem could be further quantified and made visible. As quoted by the State of India's State of Environment Report, 1982:

Sustained campaigns against polluters in Goa, Kerala, Shandol (Madhya Pradesh), Ganjam (Orissa), and Burhanpur (Gujarat), among other places have forced government officials to take notice and sometimes act. The Water Pollution Prevention and Control Act of 1974 was enacted, at least partly, due to public pressure. The progress in its implementation, however, has been unsatisfactory and uneven. (CSE, 1982, 19)

In 1981, a grim picture of the country's water pollution had also been presented in the Environment chapter of the Sixth Five-year Plan:

There is now a wealth of documented evidence of the adverse effects of water pollution from all over the country. These range from the transmittal of waterborne diseases like cholera, jaundice, typhoid and dysentery to fish kills and loss of agricultural productivity through the use of polluted water. From the Dal Lake in the North, to the Periyar and Chaliyar rivers in the South, from the Damodar and Hooghly in the East to the Thana Creek in the West, the picture of water pollution is uniformly gloomy. Even our large perennial rivers like the Ganga are today heavily polluted. (Planning Commission, 1981, Sixth Five-year Plan, 20-23)

3.2.2 *Ganga Action Plan*: the stabilization of a 'Ganges pollution problem'

In the years prior to the *Ganga Action Plan* (GAP), Prime Minister Indira Gandhi is reported to have personally mandated in 1982 a study of the river pollution in fourteen Indian rivers (Vincent, 2013). The publication 'The state of India's environment 1982, a citizens' report' (CSE, 1982) confirms that the Central Board for Prevention and Control of Water Pollution (CBPCWP) was mandated to release a compilation of all the available literature on the Ganges pollution by end of 1982. It also mentions a Planning Commission's programme named 'Sky to Ocean' to fight the pollution of the Ganges River, with, as a part of it, the launch of integrated studies involving several universities on this subject (CSE, 1982, 26). This programme was however not reported in the Sixth Five-year Plan published in 1981; in the Seventh Five-year Plan, released in 1985, one finds a

short description of the proposed *Ganga Action Plan* (GAP). It thus corroborates that the Central government under Indira Gandhi's political term was the investigator of the Ganga programme in the years 1982-1983 but that the programme had to be postponed further to her assassination in 1984 (Alley, 2002; Vincent, 2013). In her work, Vincent evokes the personal attachment towards the Ganges River that Indira Gandhi explicitly acknowledged in a book's introduction, to explain the genealogy of the GAP (Vincent, 2013). Indira Gandhi linked this attachement to her childhood in Allahabad, at the sacred confluence of Yamuna and Ganges Rivers, where:

The moods of rivers are fascinating to watch but even more so are the faith and reverence they evoke in the hearts of millions. To one born in Allahabad this is imprinted on the mind by the constant stream of pilgrims who journey long distances to take a quick dip in the waters of the Ganga (in Sivaramurti, 1976, vi cited by Vincent, 2013, 116)

In addition, some journalists and activists contributed to publicize the official assessments of Ganges pollution. They aimed at making the paradox of a sacred and 'pure' river being contaminated 'visible'[42] for political leaders. The Bengali journalist Sunanda Datta-Ray raised for instance that exact paradox in 1980, in a paper entitled 'Pollution spreads to India's sacred river' in 'Earthwatch' (Datta-Ray, 1980, cited by CSE, 1982). The India's State of Environment, 1982 also emphasizes this contradiction in several occasions in its 'water' chapter and even refers, with irony, to a debate that took place at the Indian Parliament:

The oldest myth about the Ganga River is ensconced in the tale of Bhagirah who was able to persuade the goddess Ganga to come down from heaven to earth […]. The newest myth was created by a courageous Union Cabinet Minister who foolhardily declared before Parliament that the Ganga could never be polluted[43]*.* (CSE, 1982, 23)

[42] Recurrent fish mortalities in the West-Bengal stretch of the Ganges or near Kanpur, or again the Ganges 'taking fire' near Monghyr in 1968 due to oil refinery's effluents were known, well before the early 80's. In an interview, I was told that a wealthy family residing next to the Hooghly River did not collect the Ganges water from that river for pujas in the 70's, because of the pollution, and instead used water brought from the River's upper stretches in the Himalayan region.

[43] I don't develop further this topic. It however exemplifies the resistance to the stabilization of the 'Ganges pollution problem'. This resistance was fuelled by some religious understandings of the river (Alley, 2002 investigates this question in depth and clarifies it). It was also supported by ancient and recent accounts of

This report finally ends its section dedicated to the Ganges pollution by this kind of provocative stance:

Shiva is no longer required to protect the Earth from the Ganga; now the Ganga itself requires protection from the violence of people. (CSE, 1982, 26)

Finally, it was Prime Minister Rajiv Gandhi, Indira Gandhi's elder son who came to power in 1984, who inaugurated the GAP in June 1986, in Varanasi. The creation of a *Central Ganga Authority*, chaired by the Prime Minister, preceded the GAP by a year (DOE, 1985, Ganga Action Plan). The GAP focused on the problem of municipal untreated wastewater through the creation of assets, mainly water treatment plants in tier-1 and tier-2 cities (whose population stands above 50,000 inhabitants).

In a conflictual context, where environmentalist pressures opposed religion-inspired resistances to the very idea of a 'polluted' Ganges, Rajiv Gandhi had to carefully navigate within those contradictions in his GAP inaugural discourse at Varanasi, on June 14, 1986. As Alley noted:

[Rajiv Gandhi] made a significant statement about the nature and quality of the river Ganga, one that cut through several cultural logics and tied core symbols together to create a curious bricolage. (Alley, 1998, 171)

In order neither to alienate religious figures' support, nor to hurt people's beliefs, he thus did not directly mobilize the sacredness of the river to justify the need for fighting the pollution. He instead confirmed that: 'the purity (*pavitrata*) of the Ganga has never been in doubt' (Gandhi, 1986 cited by Alley, 1998, 171 and with her inclusion of Hindu words). But he introduced the alternative notion of material pollution that does not contradict the sacred purity (*pavitrata*), with the terms of dirtiness (*gandagi*), dirt (*gand*) and clean (*saf)* waters (ibid). Finally, he mobilized the Ganges as a 'symbol of our spirituality'. That expression could

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specific material properties of the Ganges water. These properties are reported to allow the Ganges water (*Ganga jal*) to be stored for decades without getting spoiled, thanks to an exceptional self-purifying capacity. Dr. DS Bhargava from Indian Institute of Technology, Roorkee made several research works and publications in the early 80's to corroborate these properties. Scientific investigations are still being conducted on that aspect, evoking the presence of bactericidal viruses or 'bacteriophages' (see for example Indianexpress, 24/09/2016, accessed 14 August 2018 http://www.newindianexpress.com/lifestyle/2016/sep/24/It's-scientifically-validated-now-Ganga-water-is-'holy'-1524518.html). This particular research project, as reported in the press article, was commissioned by Minister Uma Bharti, Minister of Water Resources, River Development and Ganga rejuvenation, in November 2014.

accommodate all faiths present in the multi-religious India, in line with the secular approach promoted by the Congress party since Independence and Jawaharlal Nehru's tenure[44].

3.2.3 The growing interferences with Hindu nationalist agendas

From the 1980's onwards, the increasing presence of Hindu nationalist agendas interfered with the politicization of the River Ganges[45]. This move echoed the episode presented in section 3.1.1 at Haridwar in the early 1900's. The strengthening of Hindu nationalist political forces during the 1980's broadened this trend. The following event accounted by Philippe Jaffrelot shows the emergence of an instrumentalization of the Ganges symbol by the *Vishva Hindu Parishad* (VHP), a leading pan-India Hindu nationalist organization[46]. In November 1983, less than three years before the launch of the GAP, the VHP organized an *Ekamatra Yatra* (the pilgrimage of the Unity of Mother [India]) in order to campaign for a 'Hindu political awareness' (Jaffrelot, 1993, 430). This 'political procession' or 'pilgrimage rally' relied on three groups who were rallying East-West or North-South locations (like for example Haridwar in Uttar Pradesh to Kanyakumari, in Tamil Nadu, at the extreme south of the country) and to whom 69 other groups starting from several places inland joined (ibid). During this procession, large jars filled with Ganges waters were carried and Ganges water was distributed along to devotees, at a cost of 10 rupees for 50 centilitres. The jars were then refilled with sacred waters from temples or from other sacred rivers that were met on the way (ibid). The procession met with a greater

[44] In his will, Jawaharlal Nehru refers to the Ganges symbol in a same way, in a famous quote: 'She has been a symbol of India's age long culture and civilization, ever changing, ever-flowing, and yet ever the same Ganga' (Nehru, 1956).

[45] Here, 'politicization' refers to processes that transfer an 'object', whether an event, an activity, an idea, into more generalized political debates and through-action negotiations. The term 'river politicizations' refers to the politicization of different sets of 'perceived representations' concerning the River Ganges. More details on that notion are presented in Chapter Six.

[46] To concur with the idea of a specific mobilization of the Ganges symbol since the early 80's by the VHP, one can refer to the Hindu 'minimal' code of practices that the VHP promoted in 1979 and which comprised the following three elements: the veneration of the sun, the 'OM' symbol to wear, the *Bhagavad Gita* (a famous part of the Hindu epic scripture, the *Mahabharata*) to keep at home (Jaffrelot, 1993, 415). The Ganges water was not mentioned then.

success than expected, with more than 4,300 meetings, instead of initially 1,800 expected, held in 531 districts (out of 534 in total in India) (Jaffrelot, 1993 citing the RSS' press magazine, '*Organizer*', 27 November 1983). As Jaffrelot pointed out, this new type of political action manipulated highly relevant symbols for the Hindu nationalist agenda: first, the Hindu sacred geography of India reinterpreted as 'Mother India'; second, the Ganges River that could be used to reinforce the image of a national unity, as of one the rare pan-Hindu worshiped symbols (1993, 431).

In her account of the religious debates about purity and pollution of the Ganges during the 1990's, particularly among Brahman priests in Varanasi, Alley mentioned some of these political connections. At the time of her fieldwork, they however seemed to remain weak signals. In her work, she mainly highlighted the active conceptual divide between the material realm of river pollution and the 'imperishability' of the Goddess Ganga 'in both space and time'. She illustrated it with the following metaphor:

Scientific treatments to "clean" the river are only as good as soap; they cannot reach or transform divine power (Alley, 2002, 220).

She argued that this theological understanding refrained religious figures, and thus Hindu nationalists, from engaging in and publicizing Ganges decontamination efforts[47]. In 1995, she accompanied the head of the Non-Governmental-Organisation Eco-Friends of Kanpur to meet with VHP leaders. The agenda of this environmentalist was to convince the VHP leaders to include the message to save the river from material pollution during the new *Ekamatra Yatra* (pilgrimage rally) they were organising later in the year 1995 (Alley, 2002). According to Alley, the issue was finally only little publicized during the rally and failed to attract the interest of the political leaders. She also mentioned other occasions 'in which religious and political leaders have appropriated antipollution and anti-dam rhetoric' like the anti-Tehri dam struggle (2002, 223); however, she considered them as examples of brief political appropriations that reveal the lack of concern for the subject among public audiences. She showed for example

[47] She also points to other explaining factors for this unwillingness, such as the greater seduction of issues related to anti-Muslim rhetoric among Hindu nationalists (2002, 222) or for the priests, the reluctance 'to regulate the hands that feed them [the priests]' through directing behaviours in rituals, though they are invested with this moral power (2002, 229).

how the religious figure and BJP leader Swami Chinmayananda dropped the anti-dam and antipollution political struggle once he got elected to office in 1998, though he had earlier formed a *Ganga Raksha Samiti* (Committee for the Security of Ganga) and clearly articulated the call for a cleansing of the river in meetings (2002, 224-227).

3.3 A POLITICAL REDEFINITION OF THE GANGES RIVER TOWARDS A 'NATIONALIZED ENVIRONMENT'

3.3.1 The influence of the Tehri dam campaign

Recent academic works show that environmentalist and Hindu nationalist perspectives have come closer since the early 2000's. This connection contributed to shape and further transform the naming of the 'Ganges problem'. Some of its roots can be traced in the Tehri dam campaign on the Bhagirathi River, one of the Himalayan headstreams of the Ganges in now Uttarakhand State (for a more detailed presentation of the River, see Chapter Two, section 2.1 and Chapter Six). Two scholars who studied the Tehri dam environmentalist struggle in the late 1990's and early 2000's, noticed the growing influence of Hindu nationalist ideologies and political strategies in the struggle (Mawdsley 2005; Sharma, 2009). Both authors highlighted the manipulation of Hindu symbols, myths and spiritual elements in the environmentalist campaigns that could have reversely served the promotion of a Hindu communal and exclusionary agenda. In this regard, Mukul Sharma particularly scrutinized the discourses of the environmentalist Sunderlal Bahuguna, a renowned figure of the Himalayan Chipko movement of the 1970's, and of other leaders of the struggle, either environmentalists or Hindu nationalists (2009).

From Sharma's work, I draw four key features of the Ganges' 'river meaning' that were gradually emphasized and politicized within that struggle. First, the activists highlighted the River's aesthetic and emotional dimensions, as this quote from a pioneer of the Tehri dam struggle illustrates:

Even the murmuring of the word "Ganga" fills us with a splendid smell. Tide of emotions come. (Saklani, 1980 cited by Sharma, 2009, 37)

Second, this emotional feature was closely related to the appeal of the Himalayan landscapes that play an important role in Indian culture: '*the Himalayan region and Ganga are seen as symbols of a divine force, a thing of beauty and a point of contact with the infinite*' (Sharma, 2009, 37).

Third, the Himalayan region and the Ganges were 'Hinduised' as termed by Sharma: '*The movement shifts from Himalaya to Ganga, and from Ganga to a Hinduised holy mother Ganga.'* (ibid, 39) Their mentions and representations in discourses abundantly referred to the Hindu scriptures and myths.

Fourth, the spiritual and religious elements were themselves related to the idea of the nation and its unity, as the two following quotes demonstrate:

Ganga is not only a holy river, but is most important for national integrity and for cultural integrity and the oneness of our nation. (Sarawasti Chidananda, non-published, cited by ibid, 39)

Since this holy river is the only sacred symbol of our culture and national integrity, we have to protect it (T Shivaji Rao, 1992, cited by ibid, 40)

Finally, fear was mobilized[48] to create a sense of crucial urgency: there was an emphasis on threatening forces that may bring collapse and disaster, either material (earthquake, crashing of downstream cities, etc.) or immaterial (disappearance of the 'greatness' of *Ganga jal*).

These same features were revived during the *Gaumukh-Uttarkashi Eco-Sensitive Zone* (ESZ) struggle that started in 2005 in the upper stretches of the Baghirathi River and that took prominence in the years 2009-2014 (see Chapter Six). As shown above, this redefinition of the Ganges led to a reframing of the 'Ganges problem'. In a way, it gradually shifted from the representation of the need to clean a river to the need to save a landscape, a culture, a spirituality and a nation. The Congress governement headed by Prime Minister Manmohan Singh took a kind of middle-way approach in that process in the years 2008-2014. It declared the Ganges as a *National River* (my emphasis) in a high-level decision in November 2008, under the influence of proponents in the ESZ struggle (see Chapter Six). However, it then created in 2009 a National Mission *Clean* Ganga (my emphasis), whose terminology and directions stood in continuity with the

[48] Jaffrelot also pointed to the emphasis on fear, conspiracy and the creation of an 'ennemy', mainly Muslims, in Hindu nationalist movements (1993).

secularist approach of the *Ganga Action Plan*. Notably, scientific and river-basin approaches were the key references: the government of India mandated in 2010 a consortium of Indian prestigious scientific bodies, the *Indian Institutes of Technology*, to conduct the task of elaborating the *Ganga River Basin Management Plan*. The initial justification (see above the discourse of Rajiv Gandhi in 1986, who made use of the Ganges as a symbol of India's spirituality) would have become an end in itself, as presented through the *Namami Gange programme* in the next section.

3.3.2 *Namami Gange Programme* or a new policy referential

The *Namami Gange Programme (NGP)*, which aims at '*rejuvenating*' the Ganges, was launched in July 2014. It was presented as a flagship programme of the Hindu nationalist government of Prime Minister Narendra Modi at the beginning of his tenure, which started in May 2014. This programme was literally announced by the new government as a disruption from previous approaches. Discourses (mainly reported by the medias or by the government agencies, through official websites, press releases or responses to questions in the Parliament), public images (photos or images in the press or on official websites and youtube videos), and policy decisions were mobilized to convey the message of a change. The change was reflected in the objectives of the programme, as well as in the institutions and in the methods. In that sense, I argue that this programme both acts as a symptom of a policy referential shift, following Pierre Muller (2013), and as an intensifying element of the 'Ganges problem' reframing.

First, there was an immediate institutional change at the Central level around the Ministry of Water Resources, which took the name of the Ministry of Water Resources, River Development and Ganga Rejuvenation in May 2014. The Ministry of Water Resources thus took over the responsibility to oversee the 'National Clean Ganga Mission' (NMCG) that was previously under the umbrella of the Ministry of Environment and Forests (MoEF). NMCG was a central administrative body set up by the Congress government in 2011 to serve as an implementation arm of the National Ganga River Basin Authority[49] (NGRBA).

[49] The NGRBA was set up in 2009 under the chairmanship of the Prime Minister Manmohan Singh himself, in response to pressures from activists involved in the anti-dam struggle around the Bhaghirathi River at the source of the Ganges, in Uttarakhand (see Chapter Six).

NMCG was then in charge of coordinating the actions of the five most concerned States and to trigger, review and finally finance State projects, mainly of sewerage collection and treatment, in liaison with the State Programme Management Groups (SPMGs). This institutional change conferred to Uma Bharti[50], the new Minister of the Water Resources Ministry, the authority to design and implement policies for the Ganges. Further, in order to achieve cross-sectoral approaches of the River at the Central level, Memoranda of Understanding were signed with ten other ministries to synergise actions. There was, for instance, the announcement in January 2018 of the creation of a territorial Army Battalion, to contribute to the "tasks and activities related to resurrecting the Ganga", such as assisting the implementation of pollution control measures. The task force was sanctioned in July 2018 (PIB, 30 July 2018).

Second, the objectives towards the Ganges also evolved. The new emphasis on the 'rejuvenation' of the Ganges related to the metaphor of a body, which should recover its health, in line with terms usually mobilized in Indian traditional medicine. This term purposely emphasized a change in the approach that was now 'holistic'[51] or integrated, incorporating conservation and ecological concerns, in contrast with the focus of the previous *Ganga Action Plan* on organic and bacteriological water pollution:

'Our program is being functioning in a very holistic manner. This time, it's […] less about the infrastructure. In this [programme], we are talking about biodiversity, about fishes, dolphins, turtles, etc. Almost 200 to 300 years back whatever tree planting was done along the bank of river ganga, we are trying to recreate the same image. So Namami Gange is a modern project and not the same old project with backward ideas' (NMCG Director, 11 July 2016, All-India-Radio, Public Speak programme, translation from Hindi by Vaishali Gairola).

[50] This nomination is to be noted, as Uma Bharti was a Hindu fundamentalist political figure. Uma Bharti, a Hindu nun, gained political significance in the late 80s for her orator talents, at a time where a 'communalism strategy' developed among political parties (Jaffrelot, 1993). She was among the political leaders to intervene in the political rally of the VHP in December 1992 in Ayodhya, Uttar Pradesh that triggered Hindu riots, which destroyed a sixteenth century mosque and the killings of Muslim residents (about 2000 deaths were reported).

[51] This term was repeated twice by Dr Rajat Bhargav, NMCG director in an All-India Radio programme dedicated to the *Namami Gange programme* (11 July 2016, translation from Hindi by Vaishali Gairola).

The two main missions, *Nirmal Dhara* (Clean flow) and *Aviral Dhara* (Continuous flow), identified by the consortium of IITs (mandated by the previous Congress government) in their 2015 *Ganga River Basin Management Plan* report, were confirmed and publicized in official discourses, along with the announcements of new studies conducted by the *Indian Wildlife Institute* to monitor flagship species in the River.

Third, the methods were also renewed. Two directions were particularly new: the search for additional or alternative financial sources for the programme and the attention to the raise of people's awareness. As early as July 2014, the government of Narendra Modi publicized its will to devote a much larger budget to the Ganges than the previous programmes: 20,000 crores INR (more than 2,5 billion dollars) or about ten times more than the *Ganga Action Plan* phases 1 and 2, over 2014-2019. A *Clean Ganga Fund* was created in September 2014 to collect voluntary contributions from residents of the country and Non-Resident Indian (NRI) or Person of Indian Origin (PIO), 'to harness their enthusiasm to contribute towards the conservation of the river Ganga' (PIB, 24 September 2014). This fund could notably receive Corporate Social Responsibility (CSR) contributions from private companies and allowed tax benefit compensations (a full tax exemption on CSR activities related to the Ganga Fund was announced by the Finance Minister in February 2015). Further, NMCG also worked on developing original schemes to develop Public Private Partnerships to build and operate Sewage Treatment Plants (STPs), in the perspective of securing both funding and sustained maintenance operations.

Raising people's awareness was also a key message of the authorities in promoting the *Namami Gange Programme*. This approach was in line with the global governance prescription of 'engaging stakeholders' since United Nations governing council's decision of 2002. Campaigns and programmes targeted the involvement of school children, business representatives, riverbank residents, NGOs, Gram Panchayats through various means. *Yatras* or journeys along the main stream of the Ganges with local conferences and events were organised under the patronage of the Minister, Uma Bharti[52]. Religious figures were invited to be present to such gatherings. The Minister Uma Bharti also sent explicit

[52] Press report and interviews.

invitations to the religious organisations to join *Namami Gange Programme* (PIB, 10 June 2017).

This referential shift of environmental policy towards the Ganges can be related to the need to correct mismatches with broader referentials for public action, as suggested by Pierre Muller in his introduction to the cognitive analysis of public policy (2013). Muller notably develops the idea of cycles of general public policy referentials that are usually global. He refers to the cycle of 'the State- private company', with the policy referential of 'public-sector performance', or the even more recent cycle of 'the global governance' with the policy referential of 'global efficiency' (2013, 70, my translation). The *Namami Gange programme* explicitly targeted to bridge the gap of previous approaches with these two broader policy referentials: on one side, to achieve performance in managing funds and programme implementation, as a private company – here to ensure the rejuvenation of the Ganges within five years (commitment of Narendra Modi on the day of his investiture), in contrast to the failures of the *Ganga Action Plan (GAP)*; on the other side, to be compliant with global governance approaches that take seriously ecological and biodiversity issues[53] -in contrast to the narrow vision of the GAP on water pollution, or stakeholder engagement.

This referential shift is also to be linked to the broader normative prescription of 'saving the Indian culture and spirituality' that was promoted by nationalist proponents in India since the end of the ninetieth century (Rousseleau, 2018). This link was explicit in the conclusion of the Radio programme dedicated to the *Namami Gange programme*, which was delivered by the journalist himself:

'*Namami Gange is a dream of present government and we all need to come together to fulfill it. We have to save our culture, keep the rivers clean, keep Ganga clean from all the pollution because this is collective responsibility and not one's responsibility. We hope our spiritual and cultural heritage Ganga will soon be seen spotless and immaculate.'* (Chandrika Joshi, 11 July 2016, All-India-Radio, Public Speak programme, translation from Hindi by Vaishali Gairola).

In these terms, the goal of cleaning the Ganges appears to be subordinated to the one of saving the nation's culture and spirituality.

[53] Particularly in the context of India having hosted the Conference of Parties of the Convention for Biological Diversity in Hyderabad in 2012.

3.3.3 The consistency of the 'nationalized' environment approach

The Central authorities mobilized the *Namami Gange programme* as a strategic tool to convey their political messages. This is to be related to the large communication efforts, both in the country and outside it, that were deployed by the institutions involved in the programme (on websites, social medias, press releases, events targeting the Non Resident Indian community abroad, etc.). Further to its election with a large majority in May 2014, Narendra Modi's government had obviously to convince external and internal actors of its ability to bring changes where the previous government has failed. In this vein, the choice of Nitin Gadkari[54] to replace Uma Bharti in September 2017 at the head of the Ministry of Water Resources and Ganga rejuvenation allowed Modi to emphasize a change of approach towards delivering results[55].

The *Namami Gange programme* was also mobilized to intensify the 'Ganges problem' reframing into an ethical issue that contributed to strengthen traditional Hindu nationalist standpoints. The requirement of behaviours to be changed for greater coherence with elevated principles is in line with classical Gandhian themes supported by Hindu nationalist discourses (Jaffrelot, 1993). The communication also strongly emphasized Hindu myths, faith and rituals. Photos and images were explicit in this regard on National Mission Clean Ganga or Namami Gange websites. Several quotes from Narendra Modi or Uma Bharti also referred to this lexicon. For instance, Narendra Modi compares himself to Bhagirathi, the King who made hundreds of years of penitence and was finally

[54] Nitin Gadkari was a former Road Transport Minister in Maharashtra who publicized sucessful delivery of road creation programmes during his tenure.

[55] Poor results on water quality were attributed to the Programme following the monitoring data published by the Central Pollution Control Board during 2017. Press articles largely mentioned it. Further, in December 2017, the Comptroller and Auditor General of India published a performance audit of the *Namami Gange programme*, which presented severe conclusions: '*The Performance Audit revealed deficiencies in financial management, planning, implementation and monitoring, which led to delays in achievement of milestones under the programme. There were delays in approval of projects, huge unspent balances under the schemes and other deficiencies, and shortage of human resources, leading to delay in achievement of planned targets. The main objective of Rural Sanitation programme to make all Ganga river basin villages 'Open Defecation Free' could not be achieved. There were shortfalls in forestry interventions for conservation of ecology and biodiversity of the River Ganga. The use of remote sensing data and mobile application was at nascent stage. The monitoring and evaluation was found to be inadequate.'* (CAG, 2017, iii).

blessed by the Goddess Ganga (see in the first page of this manuscript), and Uma Bharti, a Hindu figure herself, confirms the image in a later speech in November 2014: '*I will again say that after Bhagirathi, Modi-ji has been born to work for the Ganga*.' (Uma Bharti, 5 November 2014, Indian Water Portal). A video posted by the Indian government on 17 August 2017 under the title 'Namami Gange: Restoring the purity of Ganga' simultaneously refers to the Ganges as 'a sublime wine of immortality', citing ancient texts, and casts pollution activities as 'unholy practices' (MyGov India, 17 August 2017). As a result, in contrast with Kelly Alley's conclusions drawn in the 2000's, the contradiction between the sacred purity of the Ganges in the spiritual realm and the material dirtiness of the River started to be presented as ethically disturbing, as the expression 'unholy practices' about pollution attests.

Finally, this programme, though presented as a disruption, also stands in continuity with previous river policies as it politicized a 'nationalized environment' (Baghel, 2014). The Ganges River is presented in political discourses and communication as a whole, following the Hindu scriptures that highlight its metaphoric dimension of a 'purifying entity' (Eck, 2012), or a Goddess. Many consequences unfold: the physical heterogeneity of the river tends to be ignored, as well as its regional and local specificities. The abstraction 'Ganges' and the prescription to 'rejuvenate' it tend to replace detailed assessment of local issues. The *Namami Gange programme* for instance relies on several measures – beautification of ghats, sewerage works, etc. that are to be replicated from one State to another. In addition, the sustained emphasis on deteriorating water quality has distracted attention from water depletion issues that are linked to groundwater extraction and water diversion. However, some recent studies have re-highlighted the critical state of the river, and the pressing threats on residents' livelihoods and water and food security: Mukherjee and al. have warned in a paper published in August 2018 about the surface water depletion crisis in the middle and lower stretches of the Ganges, due to severe decrease of the baseflow amount, up to 59 per cent from 1970s to 2016 (Mukherjee et al., 2018). However some consistency with previous approaches – the focus on pollution issues- again marked the programme: political messages about the issue of flow quantities were not delivered.

This chapter showed how mixed rationales triggered the change of referential towards the 'rejuvenation' of the Ganges, one of them being a strategic political move to convey Hindu nationalist calls for 'saving' the nation. This move exemplifies what Linton and Budds (2014) termed as 'the expression of political strategies and politics' into water, within the hydrosocial cycle. The three next chapters will further explore the hydrosocial cycle in river contexts, first with a theoretical approach, then with two zoomed-in case studies within the Ganges basin.

CHAPTER 4 – WHAT IS A RIVER? COMBINING POLITICAL ECOLOGY AND '*MÉSOLOGIE*' FOR A NEW GEOGRAPHY OF RIVERS

4.1 PREFACE

This theoretical paper was published in a French version in 2016. It reflects the initial explorations of this doctoral work that aimed to assess the literature gaps, notably among political ecology works that focused on rivers. However, I also started to investigate the basic idea of 'what is a river', following the path of Jamie Linton who explored 'what is water'. The Ganges River was an excellent case from which to raise that question, as it is simultaneously a material river and a Goddess. A troubling scientific/religious/political 'mélange des genres' infused river management policy towards the River. I therefore consulted a body of water-related academic literature in social science and history, in addition to

political ecology works. I also mobilized some physical geography contributions. In order to adequately account for the multiple dimensions of the human-river relation, I studied the theoretical framework of the *mésologie* of Augustin Berque, which proved inspiring for my doctoral work. I therefore present the approach in this article and propose to combine it with political ecology for richer relational analyses around rivers.

4.2 WHAT IS A RIVER? COMBINING POLITICAL ECOLOGY AND 'MÉSOLOGIE' FOR A NEW GEOGRAPHY OF RIVERS

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Published pdf in Appendix 1.

4.2.1 Abstract

How to rethink integrated management of river basins in the context of the Anthropocene? The authors suggest a new theoretical framework based on post-positivist geographies for a deeper understanding of environmental, political and social conflicts related to rivers. Thanks to ontological explorations of the object 'river' and to a review of river case studies using a political ecology of water approach, they confirm the potential of combining Political Ecology with A. Berque's *mésologie*.

4.2.2 Introduction

While debates go on about the characterization of a new geological period, the Anthropocene, the acceleration of physical changes on the earth surface since the mid-twentieth century challenges human societies. This acceleration is taking place both in amplitude and in rhythm, and may be experienced through land degradation, natural resource depletion, river valley reshaping or climate change. In reaction, the French authors of the book 'Manifesto for an environmental geography' (Chartier and Rodary, 2016) call for the discipline of geography in

France to take environmental change seriously. They also seek to counter the 'eco-scepticism' of some French geographers, who simply believe in the power of technologies to solve the global environmental issues. The two authors propose to reinterpret the epistemological orientations, goals and practices of geography in the contemporary context: 'the irruption of the "environment" has, according to us, definitive consequences for the geography discipline' (2016, 15). In this paper, our aim is to take seriously the call of Denis Chartier and Estienne Rodary's manifesto and to elaborate a new theoretical framework for an 'environmental geography of rivers'. The objective is to rethink existing practices of river management through the questioning of the 'grey epistemology' of rivers, such as the one promoted within the 'integrated river management approach'56. Voluntarily departing from the river basin perspective, we wish to imagine a new 'geography of rivers' in order to better capture how both ideas and materialities of rivers operate in the contemporary social order.

In order to build this framework, we will first question what 'object' a river is. To that end, we will outline a brief history of the study of rivers. This investigation will highlight some evolution of the academic representations of rivers, or ways of knowing rivers. Second, we will analyse contributions from political ecology, in particular those carried out around rivers. This literature review will identify the gaps in reporting on river-society relations. In the discussion, we will argue for combining political ecology with the 'mésologie' of French geo-philosopher Augustin Berque, a non-modern ontology inspired by phenomenological perspectives (Berque, 2014), to better capture the full texture of the relationship between society and rivers.

4.2.3 The evolution of the study of rivers: reflections on 'what object' a river is

We propose to explore the evolution of the representations attached to rivers, particularly from academic and scientific perspectives, to better understand what object a river is. We therefore draw a kind of history of the study of rivers. We choose a schematic approach that highlights the link between science and assigned objectives or between knowledge tools and knowledge strategy.

[56] This term refers to Integrated Water Resources Management (IWRM), an international reference for water management. Its initial guiding principles (Dublin Statement, January 1992) gave way to a more technical and less political approach, based on the concept of 'planning cycles' (Global Water Partnership website). It was for instance introduced within the European Water Framework Directive (2000).

Such a historical review reflects the density of the category but also the social construction effects that predetermine the perspectives on rivers. We borrow this reasoning from geographer Jamie Linton. In his book 'What is water?' (Linton, 2010), the author reconstitutes 'the story of a modern abstraction', in order to reveal the hegemonic meanings of water. Like him, we propose to retain three schematic phases: the pre-modern phase, the modern phase and the post-modern phase[57].

4.2.3.1 The pre-modern phase: knowledge accompanies dependence on the river

This phase encompasses Antiquity as well as the entire medieval period up to the Renaissance. In order to go beyond strictly Greek and Latin heritage, we draw inspiration from the book 'Civilization and the Great Historical Rivers', by Leon Metchnikoff, scientific secretary and close collaborator to the French geographer Elisée Reclus[58]. We use this work that compiled the state of historical knowledge of its time as a secondary source. This book, published in 1889 by Elisée Reclus and prefaced by him, presented an analysis of river-society relations within the Egyptian, Mesopotamian, Indian and Chinese civilizations, developed in Antiquity around the great rivers such as the Nile, the Tiger and the Euphrates, the Indus and the Ganges as well as the Yangtze[59]. Several examples, drawn from ancient texts or from archeological evidence, highlighted the common importance of rivers as the providers of water and fertile sediment for agriculture, source of food for men and livestock. This importance may be related to the divinization of rivers, such as in Egypt or in India, as this link seemed evidenced in the 'hymn to the Nile' of the Sellier papyrus, in the French translation from Gérard Maspéro:

[57] The term "post-modern" is to be taken in a broad sense. It includes all critical approaches, though sometimes contradictory, that emerged in the 1980s and that have in common to oppose the positivist approach. This proposal is in line with Mark Moberg's discussion about anthropological theories (MOBERG, 2013).

[58] Leon Metchnikoff was part of the group of Russian anarchist geographers around Elisée Reclus, with Kropotkin and others (Pelletier, 2013); he was also a professor at the Academy of Neuchâtel. His opening address at the *Société Neuchâteloise de Géographie*, published in the Bulletin de la SNG in 1885, was the subject of comments recently published by Patrick Rérat and Etienne Piguet (RERAT and PIGUET, 2011).

[59] In this book, Leon Metchnikoff developed the thesis that these isolated civilizations could develop thanks to the rivers that he qualifies as true "educators of the peoples". According to him, these societies were characterized by the development of solidarity and the organization of collective works that were imposed by the strong constraints of these environments.

‘Rises he [the Nile], the earth is filled with joy, every belly rejoices, every being receives his food, every tooth grinds’ (Metchnikoff, 1889, 211).

During this period, knowledge of rivers was rarely developed for itself, even in Greek geographies despite the idealistic paradigm. For instance, the hydrography developed by the Greek Strabo in his ‘Geography’ aimed to delimit territories and peoples and to present the main structure lines of the Anatolian space, according to the analysis of Carole Rottier (Rottier, 2010). In addition, the approach was mainly descriptive. Latin author Seneca in his ‘Natural Questions’ failed to explain floods, as the origin of rivers remained indecipherable. However, the unity and continuity of a river, from its source to its delta was already conceptualized, as evidenced by Ptolemy's ‘Geography’, dated to the 2nd century AD (see Figure 8).

Therefore, knowledge development primarily aimed to accompany the dependence on the river, in a relationship characterized by adaptation or ‘*accommodation*’ as termed by Elisée Reclus (preface to Metchnikoff, 1889). The individual and collective aim was to make the most of the river and to try to minimize its destruction –offerings to the deified river could be one such modality in this regard – without calling into question society's dependence on the river. In addition, according to Gentelle’s research works on water-related archaelogical relics in various parts of the world, the creation of water infrastructure were mainly driven by consortia of political and religious powers or, what he terms the ‘*water-belief-power’ trilogy* (Gentelle, 2003). Later in the Middle Ages, the scholastic tradition did not particularly investigate rivers, or intervene in water-society issues; according to Jamie Linton, this tradition did not develop particular interest in these questions (Linton, 2010).

Figure 8: Map established in the 15th century according to the 'Geography' of Ptolemy (Borrowed from WIKIPEDIA, 2016).

4.2.3.2 The modern phase: a conceptual distance between men and rivers

After the Renaissance, a conceptual distance between men and rivers was progressively introduced in the West. Scientists began to expect mathematics and physics to provide explanations of the world and its natural phenomena, independently of religious perspectives. This period could be schematized according to a new *water-science-power* trilogy, replacing the term 'belief' with that of 'science' in the aforementioned trilogy. In parallel, a dualism separating nature from society was developed in philosophical works like those of René Descartes. New scientific tools helped to control nature and rivers. The technologies tested during the Age of Exploration allowed the development of an elaborate hydrography that also addressed military and strategic imperatives. In the 17th century, the identification of the major stages of the hydrological cycle[60] definitively clarified the question of the origin of rivers (Linton, 2010). Subsequently, the study of rivers followed utilitarian and strategic imperatives. There was then a growing specialization of science and the gradual emergence of disciplines such as hydraulics, hydrology, sedimentology, hydrogeology, alongside those who scrutinize the quality of water and its ecology. The

[60] These stages are: evaporation, condensation, precipitation, infiltration, runoff.

mathematical approach of realities, driven by the will for a better control of them, as well as the complexity encountered by engineers in the applied sphere (such as in the tasks of engineering large dams and river valley infrastructure) led to fragmenting problems and increasing specialization in order to reduce the number of factors considered and to minimize the error of mathematical modeling (Pardé, 1959). The social dimensions of the problems tackled by 'river scientists' were dismissed, in particular the question of anthropogenic impacts on the river. Humans were not included among the objects of the study.

One relative exception may be noted: Maurice Pardé, a professor at the Grenoble School of Hydrology, formulated in the late 1940s a 'science of the rivers' or '*potamologie*' that aimed to recreate an unity of knowledge around rivers. It consisted mainly of two branches of hard sciences, fluvial hydrology and fluvial dynamics, and it referred extensively to algebra and probability calculations. However, Pardé expressly integrated the study of 'human works' into the factors of fluvial hydrology. In the introduction of his uncompleted and unpublished book 'Average annual abundance of rivers', Maurice Pardé mentioned: 'The explanations within *potamologie* must take into account and therefore develop wide knowledge of all natural geographical factors [...] as well as, even more and more now, artificial causes, that is to say the ones introduced by humans' (Pardé, 1994).

4.2.3.3 The post-modern phase: the river-society relation in question

Diverse reactions to the modernist scientific model became more prominent in the second part of the twentieth century. One of them was the increasing engagement of researchers in environmental sciences, some driven by environmental activism (Watts, 2001). The purpose of these sciences was to correct the blindness of previous scientific approaches towards anthropogenic impacts on the environment. The scientific community then developed new fields of study such as eco-toxicology or bio-indicators[61] for rivers. Researchers aimed to refine diagnoses, with the support from technical and public spheres in charge

[61] The purpose of this science is to develop and monitor environmental indicators based on the analysis of the compositions, functions, or status of selected living species. These biological indicators have the advantage of reflecting the combined effects of different anthropogenic pressures on the environment, unlike simple physicochemical indicators.

of water management, as the mobilization of this updated knowledge contributed to legitimize them. The former water-science-power trilogy however now coexists with more participative approaches linked to a water-science-governance trilogy promoted by the United Nations organisations and other international arenas.

In parallel to this move for 'more science', a critique of the modern science developed in the 1980s within various post-modernist approaches. The questioning of the hegemony of the scientific interpretation of the world taken as an object has entailed a paradigm break with regard to the 'science of rivers', even if today scientific and critical approaches coexist. Following Bruno Latour, scientists were the subject of ethnographic studies; the production of scientific knowledge was deconstructed. More radically, the alleged objectivity of modern science and its apolitical character were questioned. The dimensions of language, power, norms and social practices were associated to scientific objects that could no longer be studied in the same terms. As a consequence, studies then considered the relations between objects and subjects, between humans and non-humans, their arrangements, and their hybrids (Latour, 1991). Bruce Braun proposed the term 'non-modern ontologies' to describe all Anglo-Saxon works, particularly in geography, which adopted this framework that brought an 'ontological' and not only an 'epistemological' rupture (Braun, 2008). These theories assumed a world where the boundaries of 'what is', especially between humans and non-humans, were no longer fixed as in the 'Modern Constitution', but in perpetual recombination, following the concept of 'networks' from the Actor-Network-Theory (Latour, 1991).

In the new 'ontological era', researchers re-examine and re-investigate nature-culture or society-environment relations. The main critique to dualistic nature-culture approaches is their myopia towards the ontological dimension of the link between humans and 'natural things'. According to this perspective, the erroneous fixing of these two categories entails that the properties attributed to both of the categories by classical academic works are illusions. These illusions may thus affect the academic findings. Conversely, Karen Bakker and Gavin Bridge show how the new 'ontological' approach may enrich works in geography of resources, with the integration of the active roles of the resources – that of amplification or resistance to human projects (Bakker and Bridge, 2006).

These 'non-modern ontologies' also permeate recent works in emotional ecology (Smith, 2013), in the political ecology of emotions (Sultana, 2015), as well as hydrosocial studies within political ecology of water (see next section). This latter approach explores features and dynamics of the 'hydrosocial cycle' that account for the *dialectical* and *internal* relation between water and society (Linton and Budds, 2014). In the same ontological vein, but according to a different conceptualization based on a phenomenological perspective[62], the French geo-philosopher Augustin Berque has developed what he terms '*mésologie*'[63] or the study of 'milieu' i.e. the neither entirely objective, nor entirely subjective relation between humans and their environment (Berque, 2014, 2016). In Berque's works, the milieu is simultaneously physical, ecological and human interpretation (2014).

4.2.3.4 What should be concluded about the river object?

The above analysis of different perspectives on rivers as objects of knowledge in the course of history, illuminates the richness of the river object, and even questions if a river remains an object. These reflections lead us to propose a non-exhaustive typology of mental representations of the river that we list below. The order in which we present them is significant: it follows the historical development of the sciences and aims to show the progressive enrichment of the notion of river that results. These representations are the fruit of various scientific interpretations of the river. They sometimes succeed one another over time or conversely also coexist in similar periods despite some potential contradictions. These contradictions also happen among social representations, which are plural; for instance, in India today, the representation of the river Ganges as a divinity coexist with that of a recreational area where rafting is practiced.

Each of the following representations relates to an 'academic' perspective of the river as:

[62] This approach conceives the world as follows: 'objects and subjects interpenetrate each other to form a geographical world that is only accessible through lived experience' (PRADEAU, 2013, Phenomenology article). Eric Dardel also phrases: 'between Man and the Earth takes place and get sustained a kind of complicity in being' (DARDEL 1952, 8).

[63] This term should not be equated to the *mesology* developed by a disciple of Auguste Comte, Charles Robin, in the nineteenth century, which presents a positivist and determinist epistemology (BERQUE, 2014).

1. Axis, which is reported on a map (hydrography from the ancient period);

2. Element of the earth's crust, with its relatively perceptible low-water channel in the landscape despite its seasonal or inter-annual variations, its high-water channel (its valley), or, more recently, its watershed (physical geography);

3. Quantity of flowing water (this is the literal meaning of the Greek '*potamo*', translated into French by river). In this representation, the quantity of sediments transported by the river is often neglected, not without consequence (uncontrolled siltation of dams, modification of sedimentary flows which aggravates coastal erosion) (hydrology);

4. Ecosystem (seat of biogeochemical and living processes), potentially transformed by human activities (ecology);

5. Milieu. The notion of milieu, or local environment, is an explanatory factor of the traits of human society, which evolve there (positivist *mésologie*);

6. Historical and social construction, simultaneously material and discursive, shaped by human activities and in turn shaping practices, structures and power relations (concept of the hydrosocial cycle in political ecology of water);

7. Actant. Endowed with an obvious capacity of action (destruction of dikes, soil fertilization, etc.) although devoid of any intention, the river integrates continually various human/non-human networks (non-modern ontology of the Actor-Network Theory);

8. '*Trajective*' reality, that is to say neither entirely objective nor entirely subjective, simultaneously physical, ecological and human interpretation (*mésologie* of Augustin Berque, Berque 2014, 2016).

We end with this representation because it carries an explicit geographical reference. The attention to the geographical dimension in the concept of 'milieu', here the river-human relation, is better tuned to the context of a river than the concept of 'actant'.

The notion of river in academic study has thus been significantly enriched. The ontology of the river is now questioned: from being an object, a river becomes a 'milieu', here a neither entirely objective nor entirely subjective reality, simultaneously tangible and a human interpretation (Berque, 2014, 2016). As in other non-modern ontologies such as Actor-Network Theory (Braun, 2008),

Berque's mésologie breaks the object-subject conceptual divide. It also renews the understanding of the human-environment relation as a mutually and internally shaping relation, as does the concept of 'hydrosocial cycle' in the political ecology of water framework. The discussion will further develop the potential of these approaches for a renewed 'environmental geography of rivers' as called for by Chartier and Rodary (2016). Before that, however, the next section briefly reviews some studies in political ecology of water that have dealt with rivers, in order to identify some of the gaps in existing approaches.

4.2.4 Towards an environmental geography of rivers: what does political ecology teach us?

4.2.4.1 Why political ecology?

Denis Chartier and Estienne Rodary's approach explicitely refers to political ecology. Out of the seven theoretical stands that they assign to be constitutive of an environmental geography, five of them direly relate to political ecology stances. These five principles are: a *cosmopolitical* geography (explicitly addressing the political dimension), a *post-deterministic* geography (recognizing the effective shaping role of 'natural' constraints or opportunities), a geography of a *rough* world (apprehending and integrating in a conceptual level both the peculiarities –'roughness'- and the global phenomena), a *situated* geography (deepening the reflexivity of the researcher, situating the context of scientific production) and a geography of *justice* (revealing social and environmental injustices (Chartier and Rodary, 2016, 31-43). In line with political ecology approaches[64], the authors also put an emphasis on the requirement for applied extensions of academic works in order to respond to 'a desire for action' (Chartier and Rodary, 2016, 15). We therefore chose to investigate within political ecology literature the research works focusing on water.

4.2.4.2 Presentation of political ecology of water literature

Two authors, Alex Loftus and David Blanchon, each made a synthesis of the subfield of the political ecology of water (Loftus, 2009; Blanchon, 2016). Alex Loftus studied the topics that are used as well as their substance, while Blanchon points to the theoretical borrowings of the discipline. The term 'political ecology

[64] See notably the 'hatchet and seed' image proposed by political ecologist Paul Robbins, or the necessary contributions of academic works to critics but also to solutions (ROBBINS, 2012).

of water' is borrowed from Alex Loftus, while David Blanchon chooses to refer to it as 'radical political ecology'. Both authors agree that justice issues around access to water resources are the main focus of this research. According to Alex Loftus, the most prominent commonality of the subfield is 'the desire to politicize environments so that they can be transformed' (Loftus, 2009, 954). The underlying theories are mainly ecomarxism, following David Harvey and Noel Castree, and the sociology of actor-networks, despite the epistemological obstacles of such a rapprochement (Blanchon, 2016). David Blanchon highlights that this literature provides a renewed reading of the traditional themes of water along two lines: it adopts a 'radical' critique (criticism of the capitalist mode of production), as well as a critique of 'natural' approaches to water that ignore water's social construction. For instance, the case studies point to the constructed nature of drought situations as well as the power relations embedded in cities' drinking waters, particularly in relation to the privatization of water services. The theme of city water supply is predominant in the early political ecology of water studies: Alex Loftus only refers to this theme in his attempt to rethink the political ecologies of water (Loftus, 2009).

Initiated by geographer Erik Swyngedouw at the end of the 90s, the political ecology of water approach developed in the United Kingdom and then in the USA and Canada, thanks to Maria Kaika, Karen Bakker and Jamie Linton. This approach also spread beyond the Anglophone academic sphere. Since the 2000s, Francophone authors such as François Molle, Gabrielle Bouleau, Sara Fernandez, Olivier Graefe and David Blanchon have developed academic works that explicitly refer to political ecology of water. They however clearly present a less radical perspective than the Anglophone approach (Blanchon, 2016). Their studies mainly scrutinize public policies in the water sector, particularly pointing to the unsaid choices (such as the choice of scales or of quantitative/qualitative indicators) and the blind spots of these policies.

Reflecting on the status of water is also a significant contribution of this sub-discipline (Blanchon, 2016). New conceptual tools are proposed such as the hydrosocial cycle (Bakker, 2000; Swyngedouw, 2002; Linton and Budds, 2014). This concept stands out from the hydrological cycle to account for the mutually shaping relationship between water and society. It also invites researchers to reinterpret discourses and representations of water, to reveal in particular their

political dimensions and/or the social injustice that they may entail (Linton and Budds, 2014). The academic works of the sub-discipline are thus to be related to three categories of research objectives, which sometimes get combined: a 'philosophical' approach that aims to clarify the representations and status of water, a 'political' approach that aims to denounce the capitalism, social injustices or anti-democratic measures, with a sometimes activist dimension, and finally an 'applied' approach. The latter highlights the contradictions or biases inherent in governance and water management practices, particularly those carried out at the scale of large river basins that we study more particularly in the following sub-section.

4.2.4.3 Political ecology works on rivers: a focus on governance, knowledge and scales

We present briefly here the main features, strengths and limits of political ecology on rivers, in order to help identify some key elements for drawing an 'environmental geography of rivers', as we will develop in the discussion. The political ecology literature on water initially focused on the context of urban water supply. The processes of commodification of urban water, especially in Great Britain, triggered particular interest from the neo-Marxist component of political ecology. Only a minority of political ecology of water works (about fifteen to our knowledge[65]) chose to study a river or its watershed. It is to be noted that only a few major rivers have been studied according to the political ecology approach. The largest number of studies deal with the Mekong (at least six), for example those of Bakker, 1999; Sneddon and Fox, 2006 and Matthews, 2012. These works all relate, at least in part, to the 'applied' approach mentioned in the previous sub-section. Water management and governance issues are at the core of the studies (Bakker, 1999; Sneddon and Fox, 2006; Norman and Bakker, 2009; Graefe, 2011; Tvedt, 2011; Alatout, 2012; Bouleau, 2014; Bourblanc and Blanchon, 2014).

Most of these works question scales or '*rescaling*' measures in river management policies and practices (notably Sneddon and Fox, 2006; Norman and Bakker, 2009; Vogel, 2012; Bourblanc and Blanchon, 2014). The hegemonic use of the

[65] In 2016. The reference to political ecology is not always explicit, but these texts refer to the key concepts of the discipline like the 'hydrosocial cycle' or to authors such Erik Swyngedouw, Karen Bakker or Jamie Linton.

watershed concept, promoted by international organizations, the European Commission and many States, is often criticized such as in the studies by Olivier Graefe and François Molle (Molle, 2009; Graefe, 2011). A main topic of these studies is thus related to research in 'politics of scale' (Swyngedouw and Heynen, 2003; Rangan and Kull, 2009). This research aims to reveal the social construction of scales in contrast with their misrepresentation as a given.

The works also successfully address a classic theme of Political Ecology: the social distribution of benefits and costs, within the nested perimeters of river management (notably Molle 2005, Matthews 2012, Vogel 2012). The context dictates the selection of sub-themes of study, for example hydropower (Mekong River), agricultural modernization (Chao Phraya River: Molle, 2005), segregationist policies (rivers of South Africa: Bourblanc and Blanchon, 2014), colonialists (Nile River: Tvedt, 2011) or nationalists (River Jordan: Alatout, 2012). Each specific river narrative prescribes (or ignores, according to the context) the study of geopolitical, economic or legal aspects. They also guide the relative attention paid by the researcher to institutions, political groups, producers, scientists, militant movements or other actors involved in the production of knowledge, in the choice of scales for political representation and decision-making, as well as in the allocation of access to water.

However, we note that the ecological and material dimensions of the river are rarely addressed in these studies. This observation concurs with the critiques formulated by works that reinvest the material dimension such as 'bodily' or feminist geographies. Nevertheless, two works are exceptions in this respect: Garry Peterson proposes to model the river in its socio-political context as an ecosystem interacting with its own environment, from his case study on the Columbia River (United States) (Peterson, 2000). The case study, however, only retains salmon as the representative species of the ecology of the river, without justifying this choice. It also perpetuates a juxtaposition of ecological aspects on the one hand and socio-political on the other (dualistic ontology), based on the social-ecological system approach (Berkes et al., 2003). The second exception is the research conducted by Gabrielle Bouleau on the Rhône and the Seine rivers in France. In her study, the biological indicators that were selected by authorities for each of the rivers, are detailed and their choices questioned. Her work

reveals a river-science co-production, in line with the hydrosocial approach (Bouleau, 2014).

We also note that sensitivity and emotional registers are mainly absent from the political ecology of river works. A similar finding led some geographers to reinvest the emotional dimension that permeates the world. Some of these authors include it within their object of study, like Farhana Sultana who explores the 'emotional work' of women in Bangladesh when they have to negotiate daily an access to healthy water, free of arsenic (Sultana, 2015). Others instead investigate this dimension with respect to the researcher's practices or ethics, pointing to the additional academic insights that it may trigger (Smith, 2013; Chartier and Rodary, 2016).

Finally, if representations and imaginaries of water are sometimes mentioned in the river narratives (Bakker, 1999; Molle, 2005; Sneddon and Fox, 2006; Alatout, 2012; Bouleau, 2014), they are often not much developed. The symbolic, ethical or religious dimensions that are potentially related to those rivers are not subject to specific analyses. However, these bonds and attachments are likely to play a significant role in the 'stragetic field of power relations' (Foucault, 2001), through collective or individual actions[66].

4.2.5 Discussion: the contours of an environmental geography of rivers

Our analysis confirms the relevance of political ecology for an 'environmental geography of the rivers' as it reveals and explains the knowledge mobilized in dominant discourses, the 'politics of scale', as well as the social, environmental or anti-democratic injustices in the management of rivers (in reference to the first five principles proposed by Chartier et Rodary, 2016). We propose to mobilize in particular the hydrosocial cycle framework as it proposes a relational

[66]A recent literature seems to be paying attention now. For instance, Suzanne Dallman's paper relates the spiritual and emotional connections between the Winnemem Wintu tribe and its residual sacred spaces, threatened by the extension of the Shasta Dam in California (Dallman et al., 2013). Dallman shows how these links, perceived as inseparable from the identity and memory of the tribe, triggered the tribe's struggle – however rather symbolic - against the dam project. An American anthropologist also published in May 2017 a book exploring the political ecology of dams on the upstream Ganges with a central focus on the role of the Hindu faith in local movements (Drew, 2017).

and non-dualist approach of the study of water-society interactions. It notably addresses the seventh principle of Chartier and Rodary, or the 'lâcher-prise' - 'letting go' or renouncing to the will of controlling space and territories (Chartier and Rodary, 2016, 31-43). However, with regards to the density of the river-society relations that the first part of the paper highlighted, these research works tend to neglect two questions that are *a priori* significant, especially when compared to other water resources (groundwater, reservoir, canal, network of irrigation) that are more homogeneous and perhaps less 'civilizational' or prone to various cultural and social interpretations[67] than rivers.

The two research questions that could be further addressed in river contexts are:

1. to what extent the physical and ecological heterogeneity of the course of a river is involved in the co-construction of society and river;
2. how the emotional, symbolic and ideological types of discourses around a river intervene in the hydrosocial cycle.

In order to build an 'environmental geography of rivers', we propose to develop in hydrosocial cycle analysis a simultaneous attention to the specific materiality of a river, as well as to the emotions, symbols and interpretations that are attached to it, as a 'milieu' in the sense promoted by Augustin Berque (2014). In what follows, we will examine more particularly this second aspect.

Symbols, emotions and interpretations emerge from the sensitive relationships between individuals and the river but also from collective representations, systems of preferences and values, even religions and ideologies. The importance of ideologies has been emphasized by Erik Swyngedouw in his analysis of Franco's 'hydrosocial dream' for Spain (Swyngedouw, 2007) or around the 'geopolitical imaginaries' of the Jordan, by Samer Alatout (Alatout, 2012). The religious question is also significant in certain contexts. It is for instance inseparable from the Ganges in India. It appears as a political lever for the current Hindu nationalist government through the river restoration program, *Namami Gange Programme* (see Figure 2) and as a trigger for the mobilization of some opponents (*Ganga Ahvaan* movement).

[67] If we follow the wording of Leon Metchnikoff (1889).

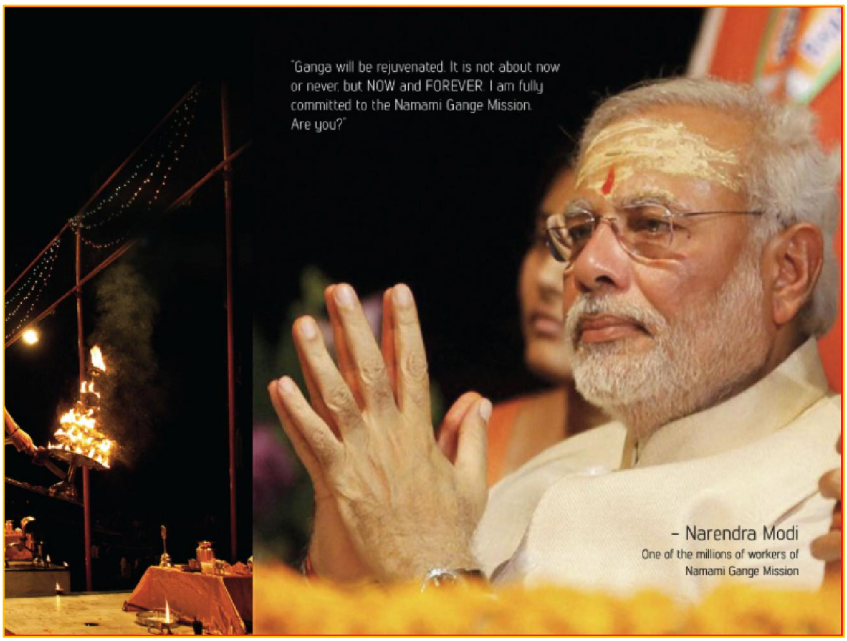

Figure 9: Promotion of the Namami Gange, a Ganges river rejuvenation program (source: National Clean Ganga Mission website, 2016).

However, in order to deepen the complex links between material dimensions (sensations, practices) and conceptual dimensions (representations, values, ethics and ideologies) in the relationship between river and society, we propose to enrich the political ecology with the *mésologie* of Augustin Berque. It should be noted that case studies in *mésologie* are rare, as the theoretical framework has only recently been consolidated (Berque, 2014). Berque's reflections, however, originate from his main field site, Japan, and from his in-depth study of the rural landscapes of Hokkaido, in which he uses advanced linguistic analyses (Berque, 1986). Mésologie explicitly belongs to non-dualistic ontologies: '*mésologie* is nothing less than a questioning of the foundations of the modern Western paradigm [which has separated object and subject]' (Berque, 2014, 67). However, we defend the compatibility of the epistemologies of *mésologie* and political ecology (as between Actor-Network-Theory and political ecology) in that the latter is more a community of practice than a discipline with fixed epistemology (Braun, 2008; Robbins, 2012).

Mésologie singularly complements political ecology through its concepts of 'milieu', 'trajection' and 'eco-techno-symbolic processes'. Inspired by a phenomenological perspective, these concepts emphasize the importance of human interpretation. The milieu, according to A. Berque, is the relationship

between river and humans. However, it's not a 'third thing' as these two poles are no longer the modern abstract poles of object and subject, but two realities 'trajected' one inside the other. The reality of the milieu is neither objective nor subjective, but simultaneously physical, ecological and human interpretation, like the ecumene or the inhabited earth (Berque 2014, 2016).

Trajection refers to the relationship, necessarily historical, of reciprocal and incessant transformation, back and forth, between the milieu and human society (Berque, 2014). The main mechanism of the trajection is the human interpretation of the 'environmental given' (*Umgebung*), 'by the senses, by the action, by the thought' (Berque, 2014, 60). The environmental given (*Umgebung*) then becomes the 'milieu' (or more broadly, the 'world' in the sense of *Umwelt*), that is again reinterpreted, with iterations. Therefore, the 'milieu' becomes in a way 'more and more human' over successive interpretations, and these iterative processes form 'trajective chains' (Berque, 2014, 73).

Finally, the proposition of 'eco-techno-symbolic processes' is of interest for our framework because it synthesizes the simultaneously material and conceptual dimensions of the relationship between humans and the river. On the one hand, it recognizes the interdependence of these dimensions: Berque highlights the 'thinking body' and the importance of 'carnal dimension of the world' in thoughts (Berque, 2016, 312-313). On the other hand, it introduces an emphasis on the symbolic and metaphoric dimensions, beyond rationality. Berque insists on this point when he evokes two processes at work in human interpretation: causal chains and metaphors (Berque, 1986). The latter, for example, have the power to blur temporality, reactivating the past or anticipating possibilities, with some consequences for the present. They thus defy causal chains: 'the reality of the milieu is simultaneously present, past and possible' (Berque, 1986, 151).

Mésologie offers an interesting contribution to an environmental geography of rivers as it enlarges the spectrum of human-river interactions to be considered, recorded and analysed in case studies. It simultaneously considers the senses (sensations), the actions (practices) and the thoughts (causal chains and metaphors), with an attention to the emic expressions (local language), but also to values, symbols and ideologies. It does not restrict the actors' perspectives to rational or strategic reasoning. It thus also enlarges the possibilities for action and for changing statu quo, particularly in the case of power imbalance, for

instance through new and creative coalitions. This insistence on the full range of human interpretation is to us absent from Bruno Latour's theoretical model, as well as, in a lesser extent, from the notion of the hydrosocial cycle, as theorized by Jamie Linton and Jessica Budds (Linton and Budds, 2014). However, this attention is crucial to capture the full texture of the relationship between society and rivers, whose richness we have demonstrated throughout this text. The Figure 10 summarizes the proposition of mobilizing both political ecology and *mésologie* for a new geography of rivers.

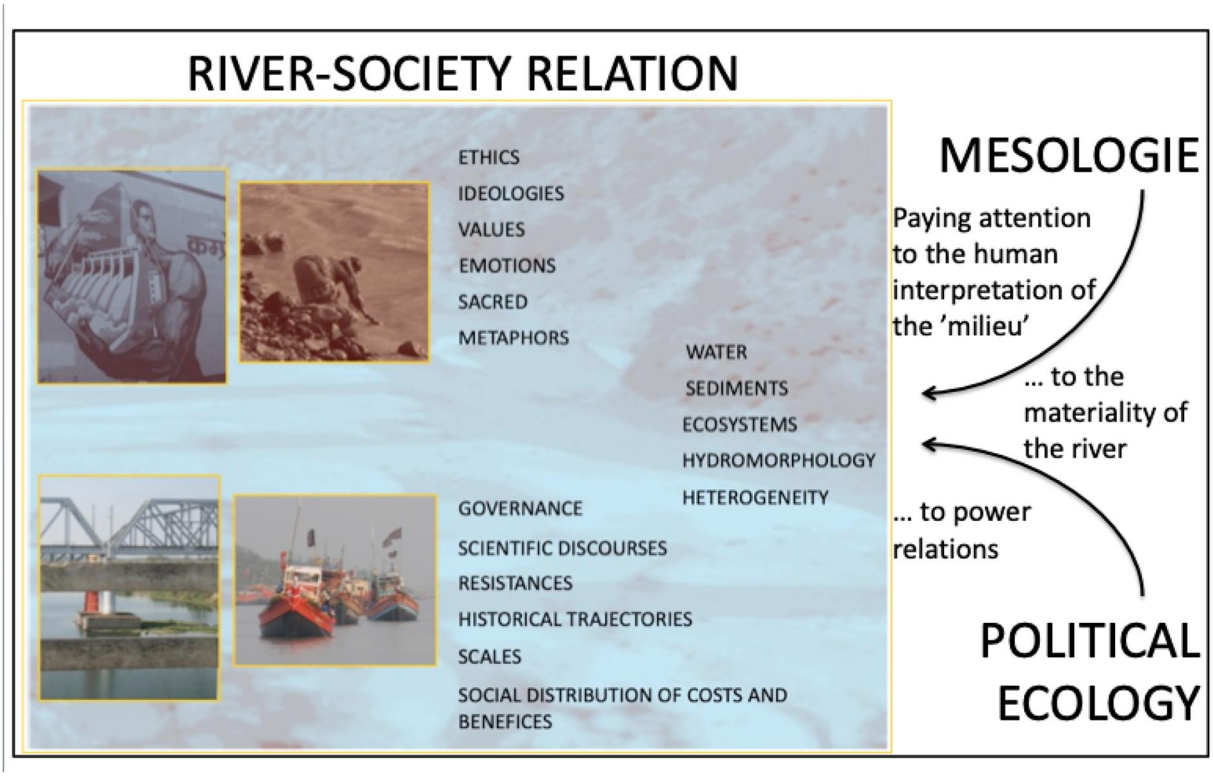

Figure 10: Combining mésologie and political ecology for a new geography of rivers

In addition, *mésologie* invites geography to 'engage with ontology' (Berque, 2014, 47) as addressed by the current of political ontology in anthropology. These recent approaches investigate the multiple potentialities of forms of existence that may be instituted by practices, or 'how things could be', in the perspective of a 'permanent decolonization of thought' (Holbraad, Pederson & Viveiros de Castro, 2014). This non-modern ontological perspective strongly renews the understanding of 'what is human?' and 'what is nature?'. The response from 'mésologie' may entail a profound reframing of river management objectives and approaches, if we carry them within management decisions. The notion of irreversible actions would be transformed; we also may move from

attempting to address the question 'what change, if pollution and lack of fresh water increase?' to 'what and who change?'.

Finally, because humans are 'trajected' in the 'milieu' and reciprocally, A. Berque proposes an ethic of the ecumene, which does not absolutize the milieu nor humans but considers them simultaneously (Berque, 2014). This proposal seems particularly relevant in the contemporary context of a double move of 'spiritualisation of ecology' and 'ecologisation of spiritualities / religions" that can be observed[68], as this raises new ethical and political questions.

4.2.6 Conclusion

This paper aimed to show the relevance of associating *mésologie* with political ecology approaches in the study of river-society relations. This combination allows deepening the apprehension of actors' positioning and the related social, ecological and political issues around river management. We also highlighted a pendulum movement oscillating between conceptual distance (modern era) and proximity (pre-modern and post-modern periods), between river and society, through the historical panorama of the study of rivers. These observations resonate with Elisée Reclus's comments on the dynamics between a society and its environment, in his preface to the work of Léon Metchnikoff. According to him, these dynamics are simultaneously movements of distancing and bringing nearer: 'In these relations [between environment and society], which are the entire civilization, man learns two things, seemingly contradictory: on the one hand, he escapes the absolute domination of certain conditions of the environment; on the other hand, he increases the points of contact with nature indefinitely, and a thousand things that were once useless have become necessary to him today' (Metchnikoff, 1889, 21).

[68] This topic was the subject of a symposium at the University of Lausanne on 10-11 April 2017 ("Towards a spiritualization of ecology?"), organized by the Institute of Social Sciences of Contemporary Religions. This conference included the presentation "Greening of religion (s)" and "Religion of Greening" from Adrian Ivakhiv, Professor, University of Vermont, USA), as well as talks dealing with the 2015 Laudato Si encyclical, the indigenous ceremonies and rituals that inaugurate international biodiversity negotiations, or the emerging networks of the "internal transition" in Switzerland.

The identification of this double movement in the human-river relationship seems to us particularly valid. It prefigures the colossal developments of river valleys in the twentieth century but also the operations of ecological restoration of rivers that 'manufacture' local environments. We also read the plurality of emotional and symbolic attachments to the river, even related identity constructions. These attachments can oscillate between indifference and affective fusion and also engender a variety of practices, from the domination of nature by infrastructure to the ritual veneration of the water of the deified river.

This proposal reinforces our desire to operationalize the study of eco-techno-symbolic interpretations related to rivers in order to identify their social and political implications. A new "political ecology of rivers" should, according to us, seize this field of investigation. We will undertake it in further research, especially around the river Ganges (Figure 11).

Figure 11: At the Ganges sources, near Gaumukh Glacier, Uttarakhand

CHAPTER 5 – PAYING ATTENTION TO MATERIALITY / WHEN HYDROSOCIALITY ENCOUNTERS SEDIMENTS (LOWER GANGES BASIN): TRANSFORMED LIVES AND LIVELIHOODS IN THE LOWER BASIN OF THE GANGES RIVER

5.1 PREFACE

This collective paper was published in *Environment and Planning E*, in autumn 2018. A first draft of the paper's ideas was presented at a conference of the Association of Social Anthropologists of UK and the Commonwealth in Durham in July 2016. The initial approach was to explore hydrosocial relations in the Lower Ganges basin that is characterized by disruptions of the sediment dynamics further to colonial and post-independence state interventions. This paper is one of the outcomes of a collaboration between University of Lausanne and Institute

of Development Studies Kolkata/Indian Institute of Technology Kharagpur during 2016-2018, initiated by Dr. Jenia Mukherjee and Flore Lafaye de Micheaux. An Indo-Swiss research exchange programme in Social Sciences, with funds from ICSSR and the Swiss federal government, financed joint fieldwork and research activities in the Lower Ganges Basin, as well as several interactions between the Indo-Swiss teams, which also comprise Professor Christian Kull and Professor Baghirath Behera. In this paper, the proposition of a 'sediment-enriched' hydrosocial cycle is one modality of a better incorporation of rivers' materiality into the hydrosocial framework.

5.2 When hydrosociality encounters sediments (Lower Ganges Basin): transformed lives and livelihoods in the lower basin of the Ganges River

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Published PDF in Appendix 2.

5.2.1 Abstract

The hydrosocial cycle is a central analytical framework in political ecological approaches to water. It helps foreground multiple and subtle interactions between water and society, culture and politics. However, to date it has dealt little with matters other than water flows. In river contexts, biotic and abiotic components play critical roles in the way people engage with and make a living out of rivers, beyond water. This article aims to advance the hydrosocial framework with a deeper consideration of the materiality of rivers. To initiate this approach, the focus is here on sediments. Lives and livelihoods connected to

river sediments remain both officially and academically under-explored. This certainly applies to the context of the Lower Ganges basin whose active channels transport huge loads of sediments mainly originating from the Himalayan slopes. Building upon an environmental history perspective and drawing on three spatially nested cases in West Bengal, India, the paper analyses instances of water-sediment-society interactions. The general case study presents colonial state interventions in the Lower Ganges basin waterscapes. The second case study zooms the focus on the 2-km long Farakka Barrage. These explorations reveal how an 'imported' conceptual land-water divide infused those interventions that led to unforeseen effects on riverine lives and livelihoods. Focusing on Hamidpur char, situated few kilometres upstream of the barrage, the third case study recounts the contemporary efforts of local communities to obtain revision of administrative decisions unable to deal with 'muddyscapes'. Finally, the paper engages with recent debates on the concept of hybridity in land-water nexus to reflect on the specific meaning and role of sediments.

5.2.2 Introduction

A large corpus of physical geography studies shows how sediments play a key role in fluvial geomorphology, river ecology and erosion or flood hazards. Despite a considerable growth in the study of sediment transport in rivers from the 1950s, in many cases, river management still focuses on flow regime at the expense of sediment regime (Wohl et al., 2015). Similarly, lives and livelihoods connected to sediments remain often both officially and academically under-explored. However, in geography and anthropology literatures, theoretical and empirical explorations of lives in shifting land(water)scapes like meandering rivers (Abizaid, 2005; Coomes and al., 2009), temporary river islands (Cortesi and Camargo, forthcoming; Lahiri-Dutt and Samanta, 2013; Lahiri-Dutt, 2014) or in deltas (Krause, 2017; Sultana, 2010) increasingly document the role of sediments in the forms and dynamics of river-society interactions.

This article aims to advance the understanding of socio-natural processes around rivers with a renewed perspective on the materiality of rivers, notably in incorporating sediments. To do so, we mobilize the political ecology of water, and particularly the hydrosocial framework that we enrich with insights from critical physical geography. The hydrosocial cycle as defined by Jamie Linton and Jessica

Budds, 'is a socio-natural process by which water and society make and remake each other, over space and time' (2014, 175). Hydrosocial analyses aim to reveal intertwined 'flows of water and power relations' (Budds et al., 2014), while studying material and discursive dimensions of water. In a related vein also linked to political ecology, the critical physical geography approach engages centrally with biophysical processes while calling for the greater attention to power relations (Lave and al., 2014).

We chose to explore this approach in the context of the Lower Ganges basin, in the West Bengal State of India. The Lower Ganges basin is an interesting case for pushing hydrosocial theory as it combines extreme features: situated within the Ganga-Brahmaputra Delta, the product of two of the world's most silted rivers and their distributaries, it is also one of the most densely populated deltas. Highly altered by terrestrial and riverine infrastructure including railway lines, roads, embankments, ports or barrages, the terrain is crisscrossed by intense human activities dependant on rivers. It is also increasingly vulnerable to climate change. The Lower Ganges basin is shaped by cyclones, coastal storms, river-induced floods, erosion and accretion phenomena, but also, indirectly, by ways of thinking about the river. The large dams and high embankments that were developed in the country since India's independence were the result, as geographer Kuntala Lahiri-Dutt puts it, of "objectification of rivers, depriving them of their right to spread over space […]. The sense of oneness with rivers and attachment to them was replaced with the sense that a river, like a wild horse, needs to be 'harnessed', 'tamed' and 'controlled'" (2000, 2399). Ruling paradigms, economic expectations and power relations around water, from close to far distances (notably in the case of the British Empire), shaped Lower Ganges basin's rivers and waterscapes that in turn shaped people's livelihoods, rulers' decisions, institutional configurations and even political movements or ideas. Thus, this part of the Indian Bengal basin, through its history and up to its contemporary dynamics, fully embodies the concept of hydrosocial cycle.

In the particular context of *chars* (the silt islands, sandy shoals or bars that frequently emerge and disappear within the riverine channels of the basin), human engagements with sediments are critical. As shown by Lahiri-Dutt and Samanta (2013), though fragile, unstable, and at risk of disappearance, these places remain attractive possibilities to some, generally marginal, human

communities, as they are fertile. *Choruas* (inhabitants of *chars*) put all their efforts in making a living from these stratified silt/sandy lands that often turn into muddy waters in monsoon seasons or get entirely submerged in one flood. These *chars*, which evolve not as landscapes or waterscapes, but as composite *muddyscapes,* exemplify instances of water-sediment-society dynamic relations.

The paper consists of five sections. Following this introduction, section 5.2.3 discusses the existing literature and justifies the relevance of proposing to enrich hydrosocial analyses in river contexts with a focus on sediments. Section 5.2.4 introduces the Lower Ganges basin and two cases where water, sediments and society interact and intermingle. The Lower Ganges basin case and the zoomed focus on the construction of the Farakka Barrage reveal how colonial and post-colonial state interventions dramatically altered the natural deposition pattern of its alluvial sediments and disrupted *Choruas*' livelihoods as well as socio-political equations. With a greater zoom in Malda district, upstream of the Farakka barrage, the third case recounts the contemporary efforts of *Choruas'* communities to obtain the revision of administrative decisions unable to deal with 'muddyscapes' (*Hamidpur char*). In section 5.2.5, further analytical insights are drawn from the incorporation of sediments into the hydrosocial framework. The discussion also engages with recent debates on the concept of hybridity in the land-water nexus. Section 5.2.6 wraps up the argument, raising possibilities for further lines of inquiry.

5.2.3 Engaging hydrosocial literature with rivers' sediments

5.2.3.1 Hydrosocial literature and river's materiality

Our approach positions itself within the 'political ecology of water', a critical literature that studies the social and political dimensions of water (Loftus, 2009). This literature mainly criticizes apolitical analyses of water-related phenomena. Case studies related to drought for example show how power relations affect access to water as well as scientific knowledge produced about water, while water scarcity gets 'naturalized' in discourses (Budds, 2009; Kaika, 2003; Mehta, 2011). In this vein, the concept of hydrosocial cycle emerged within the field to emphasize the *internal* and *dialectical* relation between water and society, drawing attention to 'how water is made known and represented, and its effects'

(Linton & Budds, 2014, 177). Such analysis may for example reveal the political processes behind the scientifically-produced 'Minimum Flow Requirements' of the Garonne River in south-western France and their effects on water control decisions (Fernandez, 2014).

Conversely, the role of the materiality of water is also acknowledged in this framework. "We contend that the hydrosocial cycle comprises a process of co-constitution as well as material circulation" (Linton and Budds, 2014, 170). In Linton and Budds' terms, water materiality is characterized by its 'agential role' in hydrosocial relations (2014, 176). For example, hydrologic processes produce material flows of water but may also be agents of social, economic or cultural reorganizations (like after a severe flood); other studies also showed the agential properties of assemblages of water and technology/infrastructure (Barnes, 2012; Birkenholtz, 2009; Swyngedouw, 2007). Political ecology of water, and within it, hydrosocial analysis, have been applied to study rivers and river basins (Alatout, 2012; Bakker, 1999; Norman and Bakker, 2009; Matthews, 2012; Molle, 2005; Peterson, 2000; Sneddon and Fox, 2006; Vogel, 2012 and for hydrosociality, Bakker, 2000; Boelens, 2014; Bouleau, 2014; Bourblanc and Blanchon, 2014; Budds, 2009; Budds and Hinojosa, 2012; Fernandez, 2014, Hommes et al., 2016; Mollinga, 2014; Perreault, 2013; Swyngedouw, 2007). However, to date, we observed that in river contexts, hydrosocial studies often restrict considerations of the materiality of rivers to water flows. For instance, the sediments that rivers carry, or the biodiversity they shelter, are often not considered or only briefly taken into account. The perspectives of dominant actors and available data often promote a view of river waters as a liquid resource only. Lack of available data on river ecosystems may be a constraint for researchers. For example, in their hydrosocial study in Peru, Budds and Hinojosa (2012) mentioned that the impacts of mining extraction on the ecology of headwaters are scarcely documented. Mollinga's (2014) study of an irrigation canal in south India also corroborates this argument as he showed that singularising the meaning of river water in productive terms was the result of a state strategy.

Some scholars however mobilize more than water flows in their analyses. Bouleau (2014) highlights the mutual shaping of scientific categories used to describe hydrosystems, like bioindicators such as diatoms or habitats such as

wetlands, and the waterscapes themselves; Perreault (2013) shows the significance of distinguishing different 'forms of nature', like sediment and water, and different qualities, like clean or contaminated, to reveal instances of local communities' dispossession in a mining region of the Bolivian Andes. This attention to materiality is also stressed by Birkenholtz (2016) in his study of water transfers from rural to urban areas in Rajasthan, showing that water's variability, spatially and temporally, affects hydrosocial relations as well as capital accumulation.

Drawing on these works and on critical physical geography that calls for integration of physical and human geographies while acknowledging the politics of environmental science (Lave, 2015), we seek to enrich hydrosocial analyses with greater attention to materiality of rivers 'over space and time'. In this regard, we choose to focus here on the sediment component of rivers.

5.2.3.2 Looking at sediments

Sediment regimes are crucial to aquatic and riparian ecosystems (see Wohl et al., 2015). Unintended ecological effects occur if sediment supply and transport are overlooked in river management (Poff et al., 2006). These findings from physical geography, sedimentology, fluvial geomorphology, hydrobiology or biochemistry on hydrosystems, confirm the importance of sediment circulation in river systems.

Building on these works, we propose to more fully incorporate sediment in hydrosocial analysis, drawing on a body of recent, critical literature that emerged in anthropology and geography dedicated to *muddy terrains*, or those places where sediments, rivers, and societies intersect (Lahiri-Dutt, 2014; Krause, 2017a; Cortesi and Carmago, *forthcoming*). We notably mobilize useful concepts and insights from Franz Krause and Kuntala Lahiri-Dutt for our approach.

Krause (2017a) proposes an 'amphibious anthropology' to adequately account for lives in deltas. This approach encompasses concepts of wetness (recognizing the spectrum of realities between dry and wet, and their local importance), volatility (instability and fluidity of humans and non-humans' interactions) and rhythms (analysis of clashing and/or corresponding ecological and social interrelated rhythms). These latter two concepts rightly reflect the high variabilities of sediment regimes; moreover, "rivers respond to changes in water and sediment

inputs at varying temporal and spatial scales, but such scales can be substantially different for sediment and water" (Wohl et al., 2015, 359). Thus incorporating sediments leads to a greater attention to temporalities and rhythms (Krause, 2017b).

Lahiri-Dutt's work has been a major inspiration for the present article. Lahiri-Dutt strongly argues for the need to "[reconsider] one of the foundational binaries [of geography], that of land and water" (2014, 1). Engaging with the concept of hybridity beyond mere material forms (or a simple mix of water and land), she reworks the 'wet theory' conceived by anthropologists like Appadurai and Breckenridge (2009). One of her aims is to bring "more fluidity in speaking of hybrid environments" (Lahiri-Dutt, 2014, 2), noting that most of geographical metaphors are related to land only. As an instance of not excluding complexities or ambiguities, she further invites critical geographers "not to give up mud and silt in favour of either land or water" in their explorations of hybridity (Lahiri-Dutt, 2014, 8), drawing empirical insights from the Bengal context. In section 5.2.5, we therefore engage with recent debates on hybridity to further reflect on the meaning, place and role of sediment in human geography.

5.2.3.3 Incorporating sediments in the hydrosocial cycle

In order to better guide our empirical investigation, our proposition is to revisit the model of the hydrosocial cycle proposed by Linton and Budds (2014), with its three components: 1. H_20, standing for water's materiality; 2. social power/structure and 3. technology/infrastructure. In this conceptualization, other aspects like discourses, ideas, representations of H_20 or knowledge are internalized in what the authors call 'water', at the centre of the cycle (Figure 12).

In our proposition of a materially-enriched hydrosocial cycle, we instead articulate four components. Referring here to the dialectical approach that infuses the concept (Harvey, 1996; Linton and Budds, 2014), we understand these components as intimately connected processes, sustaining, undermining, shaping or disrupting each other into new configurations, though belonging to different levels of abstraction and to different space-time dimensions (including the distinction between experienced or external spatialities and temporalities). The four components we propose are: 1. Meanings and interpretations (including knowledge, scientific and/or local) of *land* and water ('muddyscapes'); 2. *Land* and water-related governance and power relations; 3. Resource (here water and

sediment) use and exchange patterns; 4. Physical and biological processes, partly mediated or affected by technology. The seemingly prominence of social processes (3 out of 4) over physical processes do not refer to a quantified representation of the relative importance of those processes. The idea here is rather to make the possibilities of interactions among varied social dimensions and physicalities more visible. Figure 12 aims to illustrate these components with a limited choice of key words.

As in Linton and Budds' conceptualisation, each component exerts actions and eventually brings changes to other components affecting the whole cycle. As a consequence, the cyclical process does not follow a regular path among components; the idea of a cycle is however kept as all components of the cycle finally become affected along a historical trajectory, as shown in the empirical section that follows.

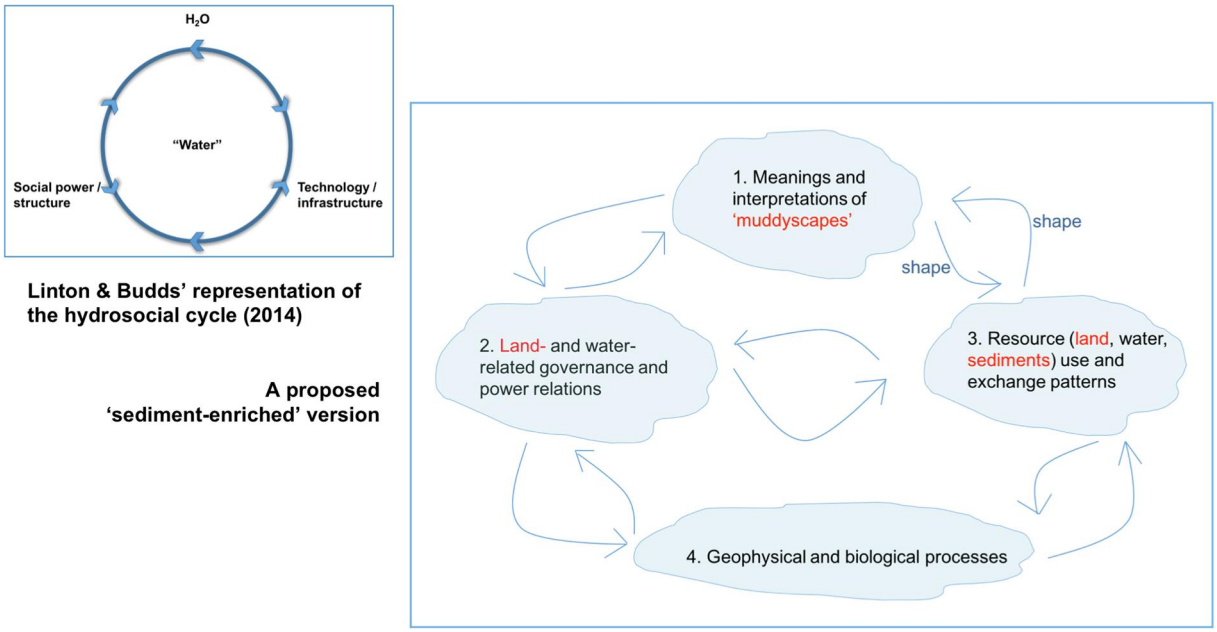

Figure 12: A 'sediment-enriched' hydrosocial cycle

Our aim is now to illustrate why sediments matter in river-society dynamics. The next section presents three cases in West Bengal, India. Our case studies are nested in temporal and spatial scale from large to small: the general environmental history of the Lower Ganges basin, the Farakka barrage construction event and its consequences, and Hamidpur *char* that is located about 11 kilometres upstream of Farakka barrage.

In each of these cases, we shed light on mutual interactions and shaping processes among the four (proposed) components of the hydrosocial cycle (see Figure 1). We particularly study the role of conceptual frames of thought (i.e. component 1) and how *Choruas*, as well as authorities, adjust and react to such 'moving terrains' (components 2 and 3). We incorporate physical processes (component 4) through qualitative descriptions, rather than through quantitative research on sedimentation and erosion, for such work in the Ganges basin lacks sufficient data (see notably Wasson, 2003; Singh, 2015). In this way, we depart from a true socio-sedimentological case of the kind that critical physical geography would call for. Through our cases, we focus instead on how the land/water divide worldview has affected people's living conditions in the Lower Ganges basin until now.

5.2.4 The Lower Ganges basin: transformed lives and livelihoods

5.2.4.1 Introducing the lower basin of the Ganges River

...a riverine plain that is part land, part water, but is neither in its entirety…
from the breadth of the delta mouth
to the microcosmic worlds of silt islands or chars that lie within the riverbeds
Kuntala Lahiri-Dutt (2014, 4)

Shared by India and Bangladesh, the vast alluvial plain of the lower basin of the Ganges River is characterized by an intricate network of interlacing channels and abandoned meanders, as well as marshes and occasional higher lateritic tracts. The Ganges-Brahmaputra delta is a tide-dominated delta with highly turbid estuarine channels. Deposition processes characterise the delta, as the river slope is only about 4 cm/km (Singh et al., 2007). The active Ganges channel upstream of the delta is highly sinuous, making large meander loops within a 20-30 km wide valley (Singh IB, 2008). Two hydrological phenomena dominate. First, there is huge seasonal variation in flow discharges due to the monsoon regime: monsoon flows (July-September) reach 10 to 100 times non-monsoon

flows (Singh et al., 2007). Second, the river transports a considerable amount of sediments to the delta area (600 to 1200 million tons/year bedload, Wasson 2003), mainly from upper Himalayan highly erodible slopes (Wasson, 2003). Singh et al. (2007) note that about half of the sediment discharge to the world's oceans originates from the rivers of South-East Asia due to the morphodynamic evolution of the Himayalan range. Monsoon flows thus carry about 90% of the annual sediment load into the delta region (Singh IB, 2008). As a consequence, in monsoon period, "bankfull discharges result in an enormous spontaneous transportation of sediments to the Bay of Bengal along with changes in the river channel morphology" (Singh et al., 2007, 157). The Ganges riverine system therefore remains dynamic, with bank erosion, accretion, and changing courses of rivers (Rudra, 2014).

Our empirical focus is on the Indian part of this geographical unit, within the state of West Bengal. The river Ganges enters the West Bengal State in the Malda district, with the Rajmahal Hills on the right side. After some 35 km, at Farakka, the Ganges bifurcates[69] into two major branches, the Padma River (in a south-east direction, towards Bangladesh) and the Bhagirathi River (to the south, towards the city of Kolkata). In the centuries leading up to the Farakka Barrage, the Ganga-Padma River was the main branch. The slowly decaying Bhagirathi River used to birfucate about 40 km downstream, near Mithipur, Murshidabad district. However, the commissioning of the Farakka Barrage in 1975 on the Ganges, a diversion structure designed to increase the flow in the Bhagirathi River, put an end to the natural degeneration of that channel. The Bhagirathi River is now constituted of a 39-km long feeder canal that is derived from upstream of the barrage, and joins the sea about 300 km downstream. In its tidal stretch, notably in Kolkata, the river is named Hugli River. The river finally merges with the Indian Ocean near Sagar Island, on the western side of the Sundarbans, a complex of coastal islands. Dynamic phenomena of coastal erosion, accretion and submersion continuously shape and reshape these deltaic islands or tidal bars (Figure 13).

[69] The description simplifies the situation, as the whole system is more complex with temporary disconnected or reconnected distributaries or channels, according to intensities of dry and monsoon seasons and sedimentation/erosion processes.

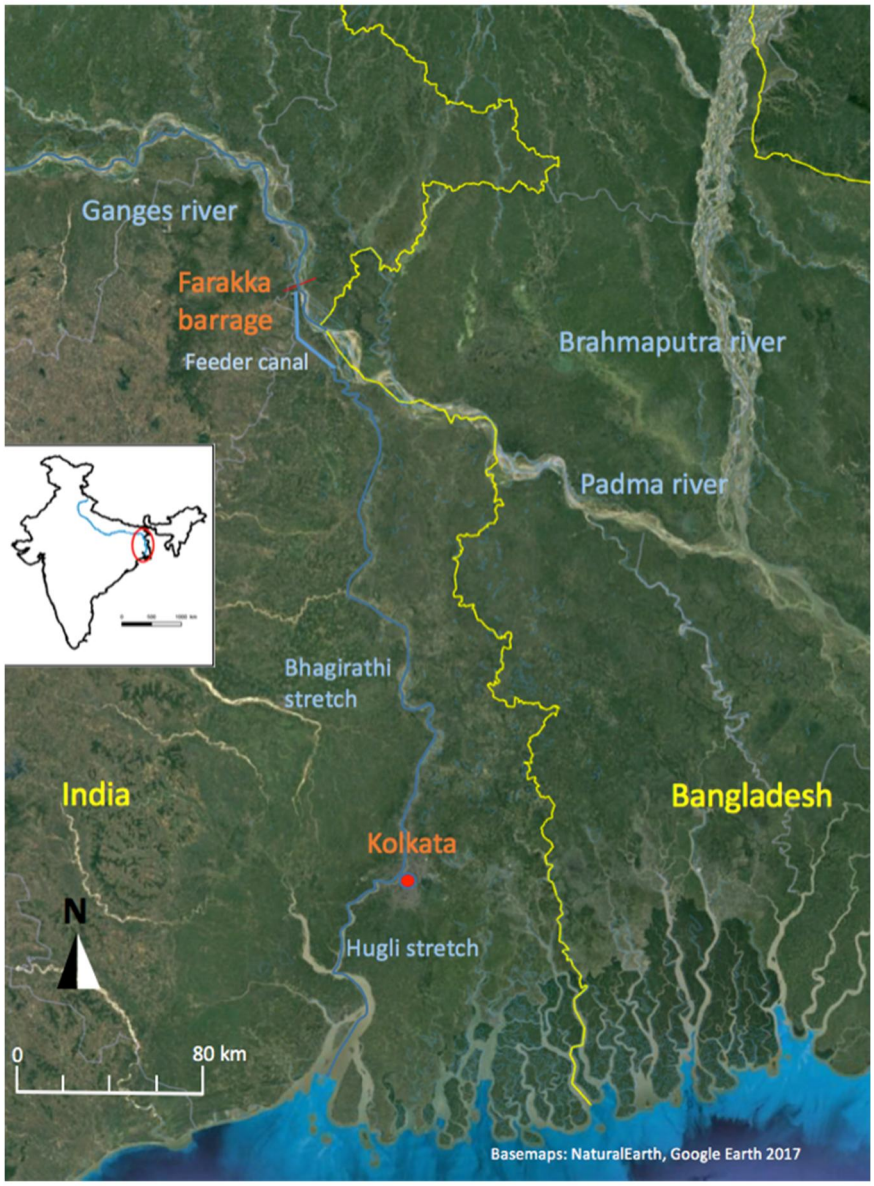

Figure 13: Schematic map of the Lower Ganges basin

Figure 14: Nirmal *char* in Murshidabad district, West Bengal

The dynamicity and the changing courses of the Bengal basin's rivers also lead to the creation of channel bars or "sandy islands". Locally termed as *chars*, these silted/sandy bars frequently emerge or disappear among riverine channels, as the sediment is deposited then gradually moved downstream. The distinction between suspended load and bedload is difficult to make in the Lower Ganges basin: Ganges river sediments show a strong overlap of grain size between bed load and suspended load deposits (Singh IB, 2008). Both bed and suspended load consist of mainly fine to very fine sand; the suspended load also includes a high proportion of silt and clay. In particular, very fine sand and silt-clay fraction constitutes the sediment of the Bhagirathi (Singh IB, 2008). Nearly 80% of bedload is transported as 'graded suspension' due to bottom turbulence during monsoon flows (Singh et al., 2007). A large amount of suspended load, rich in silt, is transported, then deposited on *chars*: "several centimetres thick muddy sediment is found deposited on top of channel bars after each flood, essentially representing the suspended load" (Singh IB, 2008, 354). The *chars* are made of deposited sand and silt strata, and, as a consequence, they are highly vulnerable to fluvial erosion processes (Figure 14).

Though temporary, and at risk of floods and erosion, many of these *chars* are inhabited by *Choruas* who farm and reside there. Richer in silt than coastal *chars* (where this term is also used), the riverine *chars* are fertile. They are rendered attractive by the difficulties of accessing agricultural land, as in India overall[70]. The entire delta is highly populated (in West Bengal only, there are about 57.2 million inhabitants in the 9 districts through which the Bhagirathi/Hugli River passes through[71]; 4 million in the Malda district alone) with human density average at district level in so-called rural areas up to 1700 people/sq. km (Hoara district, Census India, 2011).

The next section studies water-sediment-human dynamic relations in the Lower Ganges basin. Inspired by the Indian environmental, and more specifically water history literature (Mukherjee 2018), this retrospective situates the Farakka Barrage project within two generic « moments » in the history of the Lower Ganges basin: the colonial and the post-colonial periods.

5.2.4.2 Why sediments matter, case 1: From land/water divide to increased erosion in colonial era

This section narrates shifting configurations of the hydrosocial cycle, in relation to the disruptions introduced by colonial rulers on water-sediment-society dynamics. At the end of each paragraph, we briefly note which of the cycle components presented in Figure 1 are involved. As shown below, these material and discursive practices were largely infused by a modernist paradigm that conceptualized land and water as strictly separate entities (the land/water divide) and that restricted rivers to productive *water* channels (D'Souza 2009).

In the seventeenth century, just before the establishment and consolidation of the East India Company in Bengal, the dominant physical features of the basin were similar to modern ones: monsoon-type climate, silt-rich lands suitable for rice and other cultures and geomorphic dynamicity of rivers and channels (Bernier, 1689). Overflow irrigation was widely practised (Klingensmith, 2007).

[70] India counted more than 144 millions of landless farmers in 2011, near 55% of agriculture-engaged workers (source: Census India, 2011, http://www.censusindia.gov.in, consulted September 5, 2017)

[71] Malda (4.0), Murshidabad (7.1), Nadia (5.2), Burdwan (7.7), Hooghly (5.5), Kolkata (4.5), Howarh (4.9) and 24 Parganas North (10.0) and South (8.2) districts. Kolkata metropolitan region counts about 14 million inhabitants. Figures from Census India, 2011.

In this system, the nutrient-rich, silt-laden monsoon floodwaters were distributed, watering and more importantly fertilizing fields, spreading fish over the countryside and sweeping away mosquitoes (Klingensmith, 2007). Floodwaters were directed through a system of wide, shallow canals (*khals*) with minimal embankments (*bunds*); during the monsoons, breaches were made to these canals to allow flooding (Willcocks, 1930). As an outcome, in the seventeenth century, the French traveller François Bernier praised the prosperity of the region, stating that Bengal is richer than Egypt, producing abundant surpluses in rice and sugar and attracting foreign traders from many parts of the world for its crops, spices, silk clothes and other goods (Bernier, 1981).

The colonial era introduced major changes to existing river-society relations. The latter were characterized by *rapports d'accommodation*, or "relations of adjustment" (Reclus, 1889, our translation) or "dancing with the mood of the River" (Lahiri-Dutt and Samanta 2007). The British rulers carried with them the classical modern western paradigm that considered the environment as a mere externality (Berque, 2014) that should be tapped, in contrast to the pre-modern viewpoint of reciprocal nature-society relations (Sarkar, 2010). For instance, Colonel Cotton proclaimed in *Report on the Mahanuddy*, "all deltas require essentially the same treatment" (Cotton, 1858, 3).

Moreover, the colonizers introduced a land/water divide (D'Souza 2009; Lahiri-Dutt, 2014; Bhattacharya, 2018) or a sharp conceptual separation between river water and its sediments. In the modernist European tradition, notably since early seventeenth century, land-water hybrids like swamps, silt islands, and sandbanks were considered treacherous, leading to innumerable drainage, reclamation and embankment campaigns (Cosgrove, 1990; Morera, 2011). This mental framework was applied to colonial territories where modern hydraulic techniques (using pumps, dredging devices, locks and sluices) were used to transform precarious waterscapes into durable landscapes (see for example Bhattacharya, 2018). While 'land exorcised of water' is transformed into property, fostering revenue generation and management, flowing waters were valorised in engineering visions to generate resource output (D'Souza, 2006, 3). Rivers were seen as liquid flows and represented in financial units. For instance administrator Trevelyan mentions in *On Godavari Irrigation and Navigation,* about monsoon flows: '4,20,000 cubic yards of water/hr flowed into the sea at the rate of Rs.

500/hr i.e., 12,000/day for 240 days and it gave Rs. 2,880,000' (Rao, 2011, 149).

The British colonizers transformed the ruling paradigm towards a "rule for profit", subordinating the region to colonial capitalist relations and to British administrative and financial needs. With their smooth liquid surfaces, waterways were designated to serve as the cheapest and quickest means of transportation (Reynard, 2005). As in Orissa's Mahanadi delta, watercourses 'calibrated as arteries for trade, however, principally serve as technical arrangements to circulate the economy of land' (D'Souza, 2009, 4). In accordance with this 'colonial hydrology' (D'Souza, 2006), loaded with 'imperial science' (Gilmartin, 1994) and 'technochauvinism', rivers were channelized, shortened, dredged, embanked and straightened; numerous meanders, bends, loops, braids, adjoining wetlands, marshes, swamps and other forms of water-soil admixtures were eliminated (D'Souza, 2009). Newly excavated canals were constructed[72], with high banks that impeded easy overflow of water as well as silt deposition.

Many socio-economic consequences unfolded. An embankment regime was established. While the maintenance of overflow irrigation had previously been paid out of the general land tax and was available to all cultivators free of additional charge, the new arrangements expected peasants to pay for water use and for embankment works. The age-old overflow irrigation practiced in the Lower Ganges basin was replaced by perennial irrigation (Mishra, 1997; Mishra, 2008; D'Souza, 2002; D'Souza, 2006; Singh P, 2008; Singh, 2011). From community-managed small-scale structures, the overall irrigation system became centrally designed and engineered by scientists and technocrats under the aegis of the Irrigation Department (Gilmartin, 1994; Weil, 2006), with a clear neglect of sediments' roles and benefits. Authorities perceived floods as an obstacle restraining routine and regular revenue collection, especially after the Permanent Settlement in eastern India (Allen et al., 2017). A flood (water/silt) dependent agrarian regime transformed into a flood vulnerable landscape (D'Souza, 2002).

[72]At the same period, the emblematic Upper Ganga Canal system was excavated for irrigating the Doab region (Uttar Pradesh)

With the continuous extension of fixed embankments (dikes created by railway lines, road networks and further for flood protection itself), the flood situation only worsened with time; some places got regularly "trapped into water" for long period of time, affecting lives and livelihoods of the inhabitants (Mishra, 2008). On the other hand, the British rulers started to consider *chars* as land or assets as shown in the introduction of the *Bengal Alluvion and Diluvion Act* (BADA) act of 1825. In this act, the key factor to establishing land rights in the court of law was for instance the payment of rent, even on diluviated land. Massive survey operations were also initiated to produce cadastral maps for revenue survey lists (or *khatian*s).

5.2.4.3 Why sediments matter, case 2: The Farakka Barrage or a new cycle of disruption

This section focuses on the Farakka Barrage project that created a major disruption of the hydrosocial relations in Bengal with far-reaching consequences spatially (up to Bangladesh) and temporally (up to today). For our analysis, we however focus on river-related sedimentation and erosion issues in India.

Conceived during the colonial times, but implemented by Indian authorities in the post-independence period, the Farakka Barrage initiated a new cycle of disruption within the Lower Ganges basin. This huge infrastructure, among the longest barrages in the world (2.6 km long), was initially designed to address the recurrent and massive siltation of the Kolkata Port in order to improve the navigability of the Hugli River, as well as to flush the polluted sewage waters. Sediments were perceived as a problem and 'clear water' as the solution to generate revenue through riverine trade and transportation. Between 1853 and 1946, British experts periodically reiterated the idea of a barrage on the Ganges near Jangipur with a feeder canal to bring water surplus to the Bhagirathi river (MEA Report, 1978; Mukherjee, 2011). It is interesting to note here that the Boundary Commission under the Chairmanship of Cyril Radcliffe also considered the immense importance of the Farakka Barrage and hence deviated from the principle that contiguous Muslim majority areas should form Pakistan. Murshidabad (with a Muslim majority), where Farakka is situated hence remained in India and in exchange a non-Muslim majority district of Khulna went to the former East Pakistan (MEA Report, 1978). Re-appropriated by the Indian authorities, the Farakka Barrage Project then began in 1962 and was completed

in 1971. Between 1971 and 1975, the 39 km-long feeder canal was excavated and the project was finally commissioned in May 1975, becoming a national emblem of Indian technocracy and sovereignty.

However, the outcome of the project related to sedimentation processes was largely ill-planned. Notably, induced discharge from the barrage has not been able to reduce sedimentation at the Kolkata Port; the annual quantum of dredging in the shipping channels of the Kolkata and Haldia Ports' area has actually increased during the post-Farakka period (Rudra, 2003). The barrage has disrupted not only downstream water flow but also river sediment movements in diverse ways. The barrage has been contested by Bangladeshi authorities due to the contentious sharing of Ganges water between India and Bangladesh[73]; it has also been challenged within India by activists, politicians and local residents (press or website reports[74] and field interviews). These actors notably denounce the amplitude of sedimentation changes and their consequences in the two channels (Ganges/Padma and Bhagirathi rivers), upstream and downstream. In addition, because the barrage gates are never fully open (in order to stabilize the expected upstream pond water level, even during most of monsoon season), sediment deposition has increased, resulting in the formation of several shoals upstream of the barrage. These shoals have led to increased meandering and sinuosity of the river as well as lateral flow instability (Mazumder, 2017; Thakur et al., 2012). The ecology of the main channels, upstream and downstream, has also been transformed due to flow velocity reduction and abiotic changes (temperature and turbidity); these changes have contributed to modifications of fish diversity and abundance, notably the reduction of a high-value commercial species (Hilsa fish) population (IITs, 2012, 11-12) as well as the decrease of the emblematic Ganges dolphin (Sinha, 2000; Sinha and Kannan, 2014).

Since sedimentation has increased upstream, the riverbed has been raised, intensifying lateral erosion of sandy banks (Thakur et al., 2012). As the

[73] Though a water sharing treaty has been signed in 1997 and water data, however not available for the general public, is now shared among an Indo-Bangladeshi commission (Sen, 2017, personal communication).

[74] See for example SANDRP report https://sandrp.wordpress.com/2014/11/25/lessons-from-farakka-as-we-plan-more-barrages-on-ganga/(accessed September 21, 2017), Times of India article, July 16, 2016 http://timesofindia.indiatimes.com/city/patna/Bihar-CM-demands-removal-of-Farakka-barrage-on-river-Ganga/articleshow/53244938.cms (accessed September 21, 2017).

upstream right bank is of hard rock at the Rajmahal hills area, deep erosion mainly occurs on the left bank. As a result, for instance, in Malda district, the river channel was displaced to the left by 7 km between 1923 and 1999 (Mazumder, 2017) and more than 1 km between 2003 and 2005 within the Kaliachak-II block, erasing some villages (Thakur et al., 2012). Repeated floods have weakened soil structure of the banks. On many occasions, marginal embankments or spurs have been breached, causing higher flood damages. In the 1995 and 1998 floods, 450 people died and properties worth about 10 billion INR were damaged (Mazumder, 2017). In Murshidabad district, downstream of the barrage, erosion patterns were disrupted leading to destruction of 'mature' *chars,* already inhabited and cultivated (Rudra, 2003). Due to the increased emergence, submergence, re-emergence and re-submergence of *chars*, *Choruas* suffer from what has been called a 'SDRR' (settlement>displacement>re-settlement>re-displacement) syndrome, with some people being forced to move more than four times, and even up to 16 times within a time span of 15 years with a relative indifference from authorities (Mukherjee, 2011a).

5.2.4.4 Why sediments matter, case 3: Hamidpur *char*, West Bengal

The case of Hamidpur *char* in Malda district briefly captures some reactions and political initiatives of local *Choruas* towards these moving 'muddyscapes'. Our aim here is to narrate a story where water-sediment-society relations and processes not only generate uncertainty and fragility, but also zones of possibilities.

We visited this *char* and its inhabitants several times in 2010 for a study on livelihoods and ecosystem services, then again in July 2017 for the purpose of this research. We also visited other *chars* in the Murshidabad district. We travelled in pre-monsoon period, where one has to walk kilometres (no vehicle apart from tractors may drive on the thick sand layer) on sandy land, sometimes cultivated with underground water use or sometimes bare; we also travelled in monsoon or post-monsoon periods, when only small boats or ferries allow one to reach destinations and when green and dense fields of jute or rice demonstrate the fertility of the plain’s soils (see Figures 15 and 16).

Figure 15: Pre-monsoon 'muddyscape', Nirmal *char*, Murshidabad district, West Bengal (courtesy: Koushik Chowdhury)

Figure 16: Monsoon 'muddyscape', Hamidpur *char*, Malda district, West Bengal

We interviewed local administrators at district and local levels (district magistrate, block development officer and staff, state delegate to *Gram Panchayat*, i.e. the local council of the "village"). We consulted relevant local documentation in administrative offices (reports and maps). To complement these sources of information, we had on-site discussions with *Choruas* engaged in public activities

(member of *Gram Panchayat*, local coordinator of the West Bengal State's *Nirmal Bangla* programme, representative of the *Gram Panchayat* to the Block Disaster Management team) or in daily activities (women, elderly, farmers, etc.).

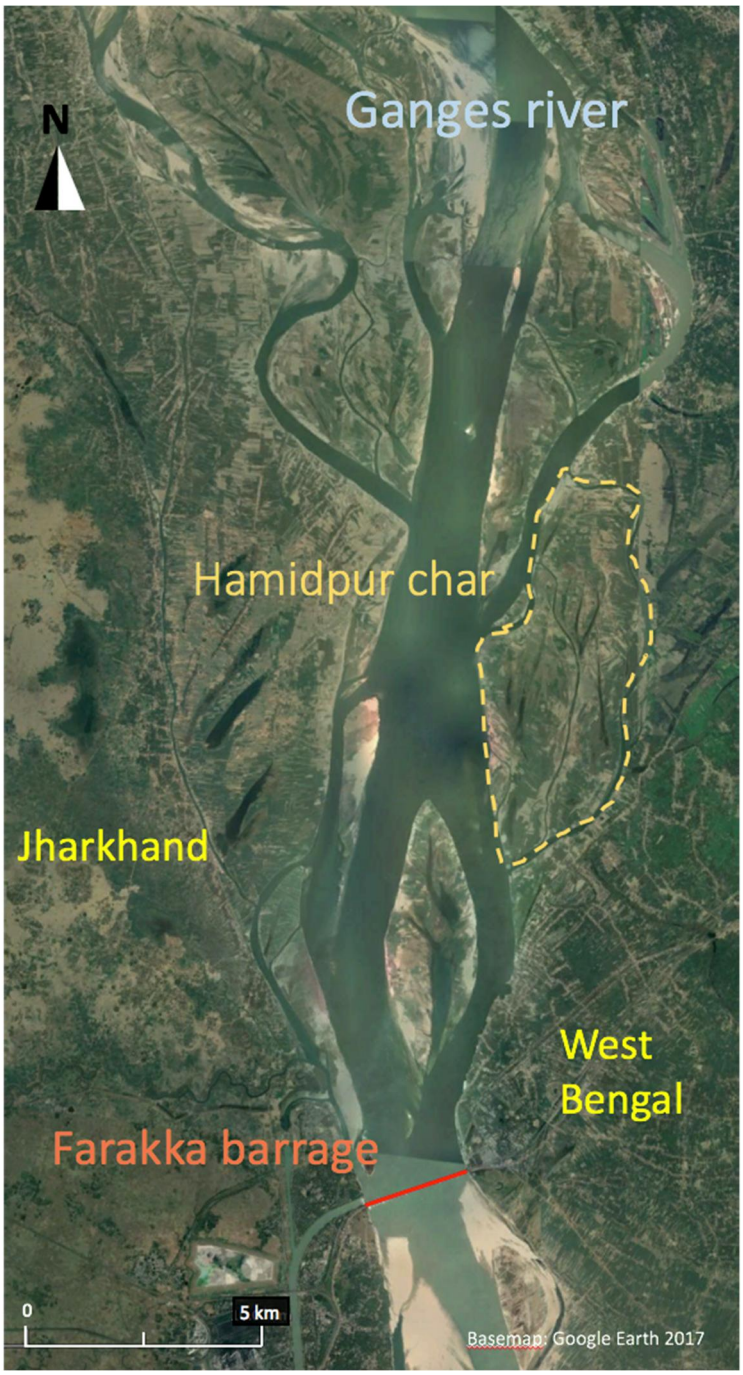

Figure 17: Location map of Hamidpur *char*, Malda district, West Bengal

In order to illustrate the dialectical co-production of river, sediment and society, and instead of labelling each paragraph as in the previous section, the main features of the hydrosocial cycle in this story, here shifting assemblages of representations and meanings of land and water, technology, materiality of river,

uses, institutional arrangements and power equations, are first summed up in the box below with ten main points.

Box 1: Hamidpur *char* case, Malda district, West Bengal

1. The post-colonial ruling paradigm, inherited from British representations such as the land/water divide and the preeminence of Kolkata port economics, led Indian national authorities to assert their capability and power through the construction of the Farakka Barrage on the main channel of the River Ganges.

2. The barrage modified water flows, but affected deposition and erosion patterns within the riverbed as well as lateral embankments' strength.

3. In the context of embankment and irrigation regimes inherited from colonial times, these changes led to increased flood and lateral erosion, with submergence of some mature *chars* and creation of some new *chars.* This caused displacement and migration of *Choruas* as well as deleterious impacts on people's livelihoods (the SDDR syndrome or settlement>displacement>re-settlement>re-displacement, see Mukherjee, 2011).

5. In response, authorities could not/did not want to deal with these uncategorized 'muddyscapes', neither fixed land nor water, subject to seasonal changes.

6. People were refused welfare program support as their land, and their official identity attached to it, were lost while the new *chars* retained the status of water-logged non-revenue land, thus "administratively orphans".

7. In reaction, grassroots movements emerged in the Malda district to build a political force to push for recognition of *Choruas*' rights and fight administrative decisions.

8. The discourse of the *Choruas* got strengthened by scientific arguments developed by scholar-activists like Kalyan Rudra about the impact of Farakka Barrage on the sediment regime.

9. These movements finally became successful in Hamidpur *char* with the delivery of identity cards, voter cards and ration cards, later with the construction of schools, flood shelters and better roads.

10. Though the *char* land remains categorized as *shikasti* (i.e. non-revenue land, whose literal meaning is 'defeated'), there is now an effective integration of Hamidpur *Choruas* in local institutions like *Gram Panchayat*, flood commission or Nirmal Bangla (state) programmes.

We now move to the detailed account of this narrative. Hamidpur *char* belongs to Kaliachak II development block, Malda district (see Figure 17). This block, situated 15 km upstream of Farakka Barrage, covers 15,700 ha and a population of about 210,000. The majority of the population are farmers. Among the 15 blocks of the Malda district, Kaliachak II is one of the most vulnerable to floods and river bank erosion. Over 20 years, about a fourth of the block territory has been eroded: 22 villages were completely destroyed and eight others partially swallowed by the River (Kaliachak II BDO, 2007). Besides erosion, floods regularly destroyed crops and housings: within Hamidpur *Gram Panchayat*boundary, eight villages remained waterlogged in 2011, 2013, 2015 and 2016 (Kaliachak II BDO, 2017).

In Hamidpur, people who were affected by land erosion due to the progressive eastward shifting of the Ganges (with massive erosion in 1971 according to local residents) had to migrate to nearby available lands. Thus, they settled in newly emerged *chars* that had appeared on the other bank of the River, in the neighbouring state of Jharkhand. There, they renamed the place Hamidpur to retain the connection with their initial land. However, they were denied any property rights as those areas are considered as *shikasti* or governmental non-revenue land according to the Revenue bill[75]. As in other *chars* of West Bengal, Bihar or Jharkhand, the lives of newly settled *Choruas* remained precarious as migrations caused an oversupply of agricultural labour force, stressing wages to low levels. Moreover, migration, trade and land conflicts, lack of public utilities as roads, communications, hospitals and maternal health facilities were other significant constrains in the *chars* (Mukherjee, 2011a; Dutta, 2011; Lahiri-Dutt and Samanta, 2013). There were also instances of illegal trafficking and other criminal activities as these areas easily remained out of authorities' sight. In the official perspective, these places were emblems of uncertainty and vulnerability

[75] Once submerged by a river channel, a re-emerged land remains governmental property and no revenue can be collected from it.

and hence unsuitable for any governmental investment (Mukherjee, 2011a) and rehabilitation issues were not considered (Rudra, 2003). Government social and health schemes were not implemented, as people were not registered as proper citizens (Mukherjee, 2011).

In 1986, a severe flood in Jharkhand drove more than half of the population of that local 'Hamidpur *char'* to move back to West Bengal. People from three to four *mouzas* (groups of villages) however remained in Jharkhand. The newcomers settled on a large and new *char* (about 7 km long and 4 km wide) that re-emerged next to the left bank of the Ganges river, separated from the western mainland by a new small river channel. That area lied approximately at the same spot of mainland Hamidpur's previously submerged areas (interview of Hamidpur GP' executive assistant, July 2017). However, the *Choruas* experienced repeated erosion and floods, notably during 1995, 1998, and 2002. Moreover, being denied rights by West Bengal authorities, they had no identity cards, neither voter cards nor ration cards that allow Below-Poverty-Line (BPL) populations to access rice and other basic commodities at low prices.

In 1998 troubled by the loss of their houses and livelihoods, and against the negligible role of the government, a small group of villagers from nearby Panchanandapur created the *Ganga Bhangan Pratirodh Action Nagorik Committee* (GBPANC). This grassroots movement received the support of action groups and NGOs such as Child Rights and You. These organizations initially aimed at better rehabilitation and relief for the *Choruas*. They then surveyed and mapped the *chars*, in order to initiate the institutionalization of these lands. They also promoted activism towards recognition and assertion of citizenship rights of *Choruas*. Scholar-activists like geographer Kalyan Rudra from Kolkata supported their cause by disseminating studies on Farakka Barrage's responsibility in sediment regime disruptions and its impact on *char* erosion in Malda and Murshidabad districts (Rudra, 2003).

Finally, in December 2010, GBPANC managed to organize a meeting at the Hamidpur *char* itself, in the presence of the Additional District Magistrate of Malda district. Inhabitants were told to bring and show to the administrator their past property entitlements. As a direct consequence of this event, in 2011, *Choruas* got identity cards and voter cards. Two primary schools and a junior school were constructed between 2012 and 2015, allowing children from the *char*

to join schools. The *char* got access to electricity in 2015, a tangible sign of marginalization reduction. Since 2014, a woman from the *char* has been elected as Member of the Hamidpur Gram Panchayat. Since *char* residents were recognized officially, this paved the way for political participation (for instance within the local flood commission, or with *Nirmal Bangla* (Clean Bengal- schemes, etc.), disaster planning, and delivery of government services (construction of emergency shelters, health programs, etc.).

Between 2005 and 2011, people thought that only classification of *chars* as *payasti* (i.e. revenue land) could lead to access to government schemes and provide official identities to *Choruas*. However, the *char* remains *shikasti* land or non-revenue land; no taxes are then collected on agriculture revenues. As a consequence, thanks to the high fertility of the *char* soil and according to the head of the Kaliachak II block, "people are not poor there" (field interview, July 2017).

This particular case of a successful grassroots movement shows the potentials and possibilities of *moving terrain* where flood or erosion may come anytime. In this case, official recognition of the residents' existence and needs has been crucial. However, as the head of Kaliachak II Block explains, Hamidpur *char* is particular in the sense that some easy identifiable land was available for the settlers thanks to re-emergence of land. In contrast, in areas of the Jharkhand-West Bengal border, many *chars* remain like 'orphans': as of now, no decision has been taken to attribute these *chars* to one of the two states. Vulnerabilities of *Choruas* there remain unabated. In 2018, GBPANC was still an active association that defined its mission as promoting a 'complete awareness' about river erosion and the associated problems (GBPANC's website, accessed September 2018). Its aim remained to put pressure on government for conducting technical assessments, understanding empirical realities and crafting policies for welfare of erosion-victims in general and *Choruas* in particular.

5.2.5 What do we miss when we miss sediments? Rethinking hybridity

These Lower Ganges basin cases reveal how sediments transported by rivers are embedded in river-society interactions. We have shown the magnitude of

Farakka Barrage's disruption of sedimentation processes in the Lower Ganges basin; and the effect of the submergence/re-emergence of *chars* on Hamidpur *Choruas*' political mobilization to fight against administrative decisions. As observed in these cases, as well as in projects like the Inter-Linking River project promoted by the current Indian government (the general aim of this project is to transfer water from water-rich river basins to water-scarce basins), river sediments are often absent from discourses and ideologies. When deposited or when in suspension, they are often misinterpreted as being only land or only water. They are however involved, along with water, in effective dynamic relations with society, shaping and being shaped by it.

Anthropologist Krause (2017b) argued recently that this land-water nexus does matter, socially and culturally, engaging with a debate around this nexus and the concept of hybridity. He suggests that a geographer's vision like Lahiri-Dutt's (2014) gives too much attention to the spatial aspect of the land-water nexus. According to Krause, it is not so much of a (spatial) hybrid but instead a lived and experienced *temporality,* "a set of spatio-temporal rhythms of increasing and decreasing wetness and fluidity" that is significant (Krause, 2017b, 1). He illustrates his approach with two ethnographic cases from Northern Europe and shows how the experience of people engaging with their 'in-between environments' (wetland, floodplain) is closely intertwined with 'inherent rhythmicity' of temporalities like seasonal floods or hydropower-oriented manipulations on water level.

Krause's approach points to 'rhythmicity', "rather than to historicity and futurity" (2017b, 5). In our interpretation, this approach pays less attention to long-term perspectives and political dimensions. In the Lower Ganges basin, these dimensions cannot be overlooked. We showed how the colonial legacy in land/waterscapes and in the land/water conceptual divide still very much infused contemporary dynamics. In such "post-colonial" landscapes, one should use political and even ontological lenses to address them, as the hydrosocial framework rightly suggests. It is the way we understand the call from Lahiri-Dutt to rethink land as "aqueous, fluid, spongeous and uncertain" (2014, 3). Beyond referring to outcomes of rhythmic physical processes like tides, floods or seasons, these terms are metaphors. They oppose colonial/hegemonic perspectives that consider lands as "terra firma" and that reify a land-water divide.

Krause also engages with the concept of (land-water) hybridity: according to him, this concept often carries implicit spatial focus (it describes a particular environment) and rather reinforces the conceptual divide between land and water (it is thought as a mixture of both, thus "[positing] them as building blocks of the world") (2017b, 2). Krause notably cites Swyngedouw's writings in 2006, where the author takes some distance with the concept of hybridity he initially contributed to develop in political ecology of water: "the notions of 'hybridity' or 'cyborg' are misleading if not radically reproducing the underlying binary representation of the world" (Swyngedouw, 2006, 113). However, Lahiri-Dutt expressly defines hybridity not as the mixture of two environments, but as the expression of flux, uncertainty and the tension between presence and absence: "sometimes a given environment, sometimes another, sometimes both and sometimes neither" (2014, 18). In that debate, looking at sediments may open new conceptual directions. Sediments are neither water, nor land, they are mineral grains. Depending on the time, on magnitude of flows, on topography, on grain size and on many other subtle factors, they may be subsumed in one or the other. Water, even with suspended sediments, remains aqueous. Sediments may thus be a metaphor of the illusory fixity of categories of land and water, and even hybridity itself, as a third "thing". They also bring plurality (the absolute number of grains and their complex chemistry and size distribution), offering in that sense many more possibilities than a singular hybridity. They finally represent what remains to be known (the complexity of physical phenomena determining one mineral grain's trajectory), resisting the attempts to master representation of reality, while – in contrast to hybridity- being in the same time a resource directly in contact with the humans engaged with their environment.

Turning back to the hydrosocial framework, thinking on the roles and meanings of sediments confirms the relevance of paying better attention to materiality over space and time in this approach (Birkenholtz, 2016). It also confirms the significance of the question 'what is water and how is it made known?' that Linton and Budds point to (2014, see also Linton, 2010; Bouleau, 2014). Finally, it complements and confirms the dialectical thinking adopted in the hydrosocial cycle concept that emphasizes processes and relations instead of fixed things and categories (Harvey, 1996; Linton and Budds, 2014).

5.2.6. Conclusion

In this paper, we showed how sediments transported by rivers are intricately interwoven into river-society interactions. The Lower Ganges basin case testifies that sediments are sites of social/physical interactions. Until now, while scientific studies and modelling address some empirical dimensions, these socio-natural realities are not much considered by Indian official authorities. For instance, the draft sediment management policy posted by the Ministry of Water Resources, River Development and Ganga Rejuvenation gives little attention to social issues: no socio-economic assessment is mentioned alongside the scientific studies, mathematical model studies or physical model studies (MoWR, 2017). The draft seems to approve activities like sand and boulder mining, construction of storage reservoirs and riverbank protection/anti-erosion in floodplains, under the condition of respecting sustainable management guidelines edited in 2016. But potentially deleterious impacts on human occupation of downstream or upstream floodplains are not mentioned in the 2016 guidelines for sustainable sand and gravel mining, edited by the Central Ministry of Environment and Forests (MoEF 2016). Human occupation in floodplains is for example qualified as 'encroachment' (MoWR 2017, 2,6-7) and not as existing occupancy that should be considered in the context of on-going changes and impacts.

The principal contribution of this paper has been to introduce and incorporate sediment within the ambit of hydrosociality. The Lower Ganges basin that is partly land and partly water, and neither in its entirety, inhabited by numerous marginalized communities, exemplifies the significance of incorporation of sediments in water research, not only from the physical [hydrological/geomorphological] point of view, but also from socio-economic, political and cultural aspects. Furthermore, these dynamics of river-sediment-society 'metabolism' extend across long-term temporal conjunctures, as we showed from environmental history.

The hydrosocial approach provides a critical alternative in considering the 'liminal spaces' of hybrid water/lands, reframing them as "not [only as] lines of separation but zones of interaction… transformation, transgression and possibility" (Howitt, 2001, 240). Sediment-enriched hydrosociality, entering the muddy terrain of Bengal basin, critically interrogates the modernist view of the environment, which "firmly believed in a watertight divide of water and lands,

robbing the rivers of their histories and extracting them from their social contexts of human experience" (Lahiri-Dutt, 2014, 9). There is much more to rivers than just water. Here, we have only pointed to sediments. One could go further to the riverine biota, nutrients or micropollutants; all are socio-natural realities begging for a broader analysis.

CHAPTER 6 – PAYING ATTENTION TO ONTOLOGY / POLITICIZATIONS OF A SACRED RIVER: THE STORY OF GAUMUKH-UTTARKASHI ECO-SENSITIVE ZONE

6.1 PREFACE

This paper was published by the *Journal for Study of Religion, Nature and Culture* in September 2019. A first version of the paper was presented at a conference of the India-China Institute of the New School, New York in April 2017 dedicated to 'Mountains and Sacred Landscapes' (ISSRNC conference). A second version was presented at the University of Lyon 2, France in the *Atelier 4* dedicated to

'Thinking about the resource in a context of rapid changes'. The Eco-Sensitive Zone conflict around dam projects in the upper valley of the Bhagirathi River, one of the headsource of the Ganges, has its roots in various environmental struggles in India. It is notably related to the Tehri dam struggle that started in the same valley, downstream, in the 1980's. The Tehri dam struggle was unsuccessful. However, in the 2000's, the environmental activists managed to gain support from the Congress government, which took the decision of creating an Eco-Sensitive Zone to prevent dam constructions. This narrative, in which the sacred dimension of the Ganges played a role, triggered my interest. I chose to rigorously investigate the political processes around the policy decision, while incorporating the lens of the human-river relation in the analysis.

6.2 POLITICIZATIONS OF A SACRED RIVER: THE STORY OF GAUMUKH-UTTARKASHI ECO-SENSITIVE ZONE, UTTARAKHAND, INDIA

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6.2.1 Abstract

The *Gaumukh-Uttarkashi Eco-Sensitive Zone* (ESZ) conservation perimeter in the Himalayan Garhwal region was gazetted in December 2012. However, this was only one moment in a tense and twisted political process, which began in 2004, between pro-dam and anti-dam coalitions. The sacredness of this holy source of the Ganges played a role in the political fate of this decision, along with conflicting perspectives defended by hydropower proponents versus environmentalists or state versus central governments. Some of the actors' motivations and political strategies derived from the formulation of a different ontology of the river, in which the river and humans are intrinsically connected or share an *internal* relation. The effects of this mobilization were volatile in the ESZ process but the ontological dimension of the conflict has had ramifications

on later politics and policies. This case highlights the interest of bringing insights from political ontology into the political ecology of water.

6.2.2 Introduction

In a global context of the 'greening of religion(s)' and the 'religion of greening' (Taylor, 2016; Taylor et al., 2016; Ivakhiv, 2017), a growing body of literature scrutinizes links and mutual reinforcement between environmental and religious discourses and/or practices. In relation to Hinduism, a sub-field in religious studies, 'Hinduism and ecology' studies the links between religious traditions and concepts of nature, and environmental ethics (Chapple and Tucker, 2000; Jain, 2016). Other scholars question the stakes and the justifications behind the joint mobilization of environment concerns and Hindu beliefs in the Indian context[76]. They notably evidenced the strategies of alliance of so-called 'green' (environmentalist) and 'saffron' (Hindu nationalist) ideologies in Indian politics (Tomalin, 2004; Mawdsley, 2005; Sharma, 2009). Some recent developments confirm those trends. Since 2014, the reorientation of the Ministry of Water Resources toward the 'Ganga rejuvenation' and the explicit Hindu imagery mobilized toward the *Namami Gange* river conservation programme initiated by Prime Minister Narendra Modi indicate the strengthening of 'Hindu perspectives' within environmental policy, particularly in relation to the Ganges River.

This move was already partially at work in the political process around the creation of an Eco-Sensitive Zone (ESZ) at the sacred[77] source of the Ganges. The ESZ decision is linked to an environment versus development dispute among pro-dam and anti-dam coalitions that happened in Himalayan Garhwal (Uttarakhand) in Northern India during the past fifteen years. The ESZ perimeter, enacted in 2012 by the central Ministry of Environment and Forest, covers a 130-km stretch of the Bhagirathi River, a source of the River Ganges, and its watershed. The stated goal of this zone is to protect the 'unique ecosystem and ecology' of the river (MoEF 2012). Some activities are restricted (construction of roads for example) or even forbidden (like industrial or hydropower

[76] See for example Sharma 2009; Alley 2002; Tomalin 2002, 2004; Mawdsley 2005; Drew 2017.

[77] In this paper, the term 'sacred' refers to a holy place in the Hindu tradition where pilgrimages occur (*tirtha*). Rana B Singh emphasizes that 'rituals and rites constantly [repeat, revive, regulate and rejuvenate] the cosmic order of sacred territory' in these places that are generally identified by mythological stories (Singh 2011: 27).

development). The ESZ perimeter officially relies on science-based justifications. However, the ESZ story is not only about protecting a pristine Himalayan ecological zone. The creation of the ESZ along this stretch of the Bhagirathi River was singularly marked by Hindu devotees' perception of the river's sacredness.

Drawing from literature emphasizing the mutually formative relations between natural elements and social and political realms, I investigate the specific case of a human-sacred river relation intervening in a political process. Specifically, I address the following research question: how does a 'river meaning' (or a representation of what the river is[78]) influence the 'strategic field of power relations'[79] related to river policy decision? Empirically, I examine the politicizations[80] of the River Ganges in the formation of the ESZ and scrutinize in what context, how and with what effects the sacred dimension of the River Ganges has intervened in the ESZ political decision. In this regard, I mobilize the hydrosocial perspective developed in the political ecology of water, which aims to capture the entanglement of 'flows of water and power relations' (Budds et al., 2014, 167). In addition, I employ the *mésologie*[81] of French geo-philosopher Augustin Berque that calls for attention to the river-human relation and its ontological implications. Empirical research shows that faith toward the River[82] intervened in the political fate of the environmental policy decision as one factor among other conflicts and politicizations of the river. This study also reveals that Ganga devotion triggered actions that had finally

[78] The term 'representation' here is in fact incomplete. Gabrielle Bouleau proposes a notion of 'perceived representations' of the environment (termed as 'environmental motives') to go beyond the only ideal dimension that the term 'representation' conveys (Bouleau 2017). The term 'environmental motive' allows Bouleau to more adequately account for the sensitive, emotional and experienced dimensions of the human-environment relation that bring actors into action (Bouleau 2017). Drawing from this proposition of particular relevance in the Indian context, I use the term 'river meaning' in a broad sense to encompass all these dimensions, beyond the cognitive one.

[79] The full quotation is: 'the strategic field of power relations, in what they are mobile, transformable, reversible' (Foucault et Gros 2001: 241).

[80] The term 'politicization' refers to processes that transfer an 'object', whether an event, an activity, an idea, into more generalized political debates and into actions of negotiation. The term 'river politicizations' refers to the politicization of different sets of 'perceived representations' or 'river meanings' attached to the River Ganges (see note 2).

[81] A theoretical framework developed in geography since the 1990s by the French author Augustin Berque. The term is borrowed from Charles Robin who created it in 1848, referring to the term 'milieu' or a society's environment. In Berque's '*mésologie*', the concept of 'milieu' refers to a reality that is simultaneously physical and an interpretation.

[82] 'Faith' refers here to Ganga devotion or reverence to the River Ganges. It is expressed through discourses and through practices (pilgrimages, rituals at home, in temples or on river banks, chants, etc.). The term 'faith' is preferred to the term 'religion' because Hinduism presents a large diversity of practices and is even a contested notion as a united religion (Pennington 2005; Narayanan 2010). However, I also make use of the adjective 'religious'.
Issues of authenticity related to the expressed 'faith' or 'devotion' are not questioned in this research.

volatile effects in the ESZ process. However, in a second level of analysis, I consider the implications of acknowledging the presence of a different ontology, here related to the sacred river, in these politics. I argue that there is a kind of 'ontological conflict' (Blaser 2013) in this dispute that has ramifications in some further developments of Indian policies toward the Ganges River.

6.2.3 Political ecology of dams, hydrosocial cycle and '*mésologie*'

The contested issues of dam building, mainly large dams, have triggered several critical analyses and political ecology studies.[83] Classical political ecology analyses have emphasized the unequal distribution of costs and benefits within resettlement procedures or competitions for resources and locations (Heming et al., 2001; Siciliano et al., 2016). Other studies inspired by a post-structural approach to political ecology have given more attention to the discursive dimension of dam building (Baghel and Nüsser, 2010). For example, several works highlight how often dams were seen as instances of modernization (Kaika, 2006; Swyngedouw, 2007; Baghel and Nüsser, 2010), prosperity, and even civilization (Molle et al., 2009; Hommes et al., 2016), thus symbolizing state power (Molle et al., 2009). Scholars also emphasize the role of symbolic and cultural aspects of both rivers and dams in the positions of the actors engaged in the pro/anti-dam struggles (Baviskar, 2005; Baghel and Nüsser, 2010; Hommes et al., 2016; Drew, 2017).

Few of these works engaged with a religious or spiritual dimension. However, in the Indian context, spiritual meanings and rituals are deeply involved in river-society dynamics (Alley, 2002; Haberman, 2006; Eck, 2012; Singh, 2013; Lokgariwar et al., 2014), and, as a consequence, around dam issues (Baviskar, 2005; Drew, 2017). While studying the pro-dam/anti-dam dispute on the Bhagirathi River with an ethnographical focus on resident communities, especially women, the anthropologist Georgina Drew attested the need to infuse political ecology 'with more religiously attuned analysis, especially in cases when resources are revered' (Drew, 2017, 6). Some of the authors consider cultural

[83] See for example, Heming et al., 2001; Nüsser, 2003; Baviskar, 2005; Kaika, 2006; Swyngedouw, 2007; Sneddon and Fox, 2008; Molle et al., 2009; Baghel and Nüsser, 2010; Hommes et al., 2016; Siciliano et al., 2016; Drew, 2017.

politics to be the adequate framework for such studies (Baviskar, 2007; Drew, 2017; Boelens, 2014; Acharya, 2015).

Sharing Drew's approach to the ESZ case, I suggest more specifically mobilizing the hydrosocial framework within the political ecology of water. The 'hydrosocial cycle' approach investigates the interactions and reciprocal effects among materiality of water (H_2O), social power/structure, technology/infrastructure, and the meanings of water (Linton and Budds, 2014, figure 4). This concept invites scholars to reinterpret discourses and representations of water to reveal the internalization of political strategies and politics, and their effects. In that sense, this analytical tool is well suited to the study of the politicizations of the Ganges River.

In order to better 'tune' the analysis of dam building with the religious -cognitive and experienced- dimension of the Ganges context, I combine the hydrosocial approach with the *mésologie* of Augustin Berque. The *mésologie* specifically deals with the human-environment relation and its ontology (Berque, 2014). Both the *mésologie* and the hydrosocial approach conceptualize the river-society relation as an *internal* relation, i.e. a relation between two poles of a single entity (Berque, 2014; Linton and Budds, 2014, 175). Mobilizing the hydrosocial framework and cultural politics, Boelens explores the interactions between cosmological worldviews, water flows and governance techniques in the context of water struggles taking place within sacred mountains in Peru (Boelens, 2014). However, in *mésologie*, attention is further implicated in the ontology of what Berque terms the *milieu*, or simultaneously the given environment and the human interpretation of it (Berque, 2014). The *milieu* is neither an entirely subjective nor entirely objective reality. *Mésologie* invites analyses not to consider the environment, here the river, as an object but to fully consider the human-environment relation through it. *Mésologie* also adds to the hydrosocial perspective better insights on the human experienced dimension of sacred spaces that Rana B Singh has highlighted in the Indian context (Singh, 2011). *Mésologie* calls attention to the interpretation mechanisms that mobilize both rationality and metaphors and that are enacted through 'senses, action, thought, and language' (Berque, 2018, 34). It thus incorporates the individual and the bodily dimensions that are generally not examined in hydrosocial studies.

6.2.4 Methodology

The aim of this study is to identify the role of faith or Ganga devotion in the ESZ political process. In this regard, the approach is qualitative and follows two objectives. First, it aims at retracing the history and developments of the ESZ decision. Second, in accordance with the hydrosocial cycle lens, it aims at deciphering the leading meanings of water (Linton and Budds, 2014), here the *river meanings* (see note 2), within actors' discourses. This approach differs from an ethnographical study as the investigation focuses on the political process that led to the decision and that followed it. As a consequence, the targeted actors belong rather to the 'policy community' (Muller, 2013), which is involved in formulating the 'referential frame' of a policy. According to Muller, the referential frame represents the norms, references or images that infuse the objectives and the broad criteria of State intervention for a defined public policy.

I encountered the ESZ story during my four-year stay in India from 2010 to 2014. I began to investigate the ESZ conflict as one of my research field sites in 2015. The case study information was gathered from archives, reports, online materials[84] and interviews. In particular, I accessed archives and documents from People Science Institute, a non-profit research and development organization in Dehradun, the capital city of Uttarakhand, which had constituted its own archival material on the ESZ process. I consulted administrative documents, publications, grey literature, affidavits, tribunal decisions, press communiqués, and written exchanges among leading figures within activist organizations and administrations. I completed and triangulated this information with semi-directed interviews in 2015-2016 of some key players in Delhi, Dehradun, and in the Bhagirathi valley, including activists, officers, Hindu figures, and officials from central and state governments, and an Anglophone press review. This allowed me to create a large corpus of published or unpublished discourse related to the conflict. Some on-site discussions in the Gaumukh-Uttarkashi valley that I studied with a team of research scholars from Doon

[84] These online materials include campaigning websites, blogs, or e-administrative documents. Many administrative documents are accessible on the web sites of the central, state, or district administrations. The development of e-governance and e-administration has been favoured in India since the early 1990's. English versions of the documents are almost always available.

University in September 2016 helped me to better understand the context. In this regard, Drew's ethnographic investigation of the conflict over the years, notably from an 'everyday religious practice and belief' and gendered perspective (Drew, 2017), enhanced my information.

6.2.5 Physical and human geography of the sacred sources of the Ganges

The case study takes place in the upper part of the Ganges river basin, which plays a significant role, both materially and symbolically, in India. Within the Ganges-Brahmaputra-Meghna river basin, the Ganges basin is a transboundary river basin shared among India which represents almost 80% of the basin, Nepal, Bangladesh, and China. It covers an area of about 1 million km^2 and concerns about 400 million Indian inhabitants. The course of the river in India is about 2,500 km long, from the Gaumukh source in Uttarakhand to Sagar in West Bengal, where its distributary, the Hoogly River, enters the Bay of Bengal. Due to the geographical location of its basin, the Ganges River is characterized by a high seasonality of its flows and by a considerable sediment transport (Singh et al., 2007; Gupta, 2008). It is also affected by human-induced phenomena like diversion of flows for irrigation and groundwater extractions, water pollution from domestic, industrial, and agricultural sources, while populations face sharpened flood, drought, and water quality issues, notably linked to climate change (Wohl, 2011). In the upper Ganges Basin, the Bhagirathi River is one of the main source streams of the Ganges, together with the Alaknanda River. They both flow in Uttarakhand, a state of India situated in the Western Himalaya region. The Bhagirathi emanates from Gangotri glacier at a place named Gaumukh (about 3,900 m elevation) in the Uttarkashi district. This river is culturally labelled as the main source of the Ganges but the hydrologic source of the Ganges is the Alaknanda, which begins its course in the Chamoli district. In Devprayag (830 m elevation) in Uttarakhand, about 200 km downstream from Gaumukh, both rivers join. There, the river acquires the name Ganga or Ganges in English.[85]

[85] I chose to keep the anglicized term Ganges throughout the text, unless authors or my interlocutors expressly mentioned the term Ganga. I have also simplified the spelling of words in Devanagari script (Sanskrit, Hindi) by refraining from using diacritical marks, as these are usually not added in non-specialist literature.

The Eco-Sensitive Zone (about 4,180 km^2) is situated in the upstream part of the Bhagirathi river basin and concerns a 130-km river stretch from Gaumukh (3,900 m elevation) to the town of Uttarkashi (1,200 m elevation). Initially meant to encompass 100 meters along each side of the river (MoEF, 2011), the ESZ perimeter ultimately covers the whole watershed of this relatively steep valley (MoEF, 2012). This perimeter is almost the same as the sub-district administrative zone of Bhatwari Community Development block. The latter represents about 56,400 rural residents; 17,500 more urban residents dwell in the two towns of Gangotri and Uttarkashi (CENSUS, 2011). Like other Himalayan valleys, the Bhagirathi valley residents may face severe hazards like storms, flash flooding, glacier lake outburst floods, landslides or even earthquakes as well as some socio-economic marginalization (Awasthi and Awasthi, 2016). Subsistence agriculture and animal husbandry are the main activities. Horticulture like apple farming, or tourism-oriented activities are in development in the Bhagirathi valley with some support of the state and district administrations. However, out-migration as a household livelihood strategy is also widely reported within the state. In the ESZ perimeter, about fourteen villages out of eighty-six are now 'ghost villages' without any human inhabitants (MoEF, 2016). The development issues of the region were at the core of the political struggle for the creation of an independent Himalayan State from the then unified Uttar Pradesh State, mainly situated in the Gangetic plain. The Uttarakhand State was created after years of popular movements and political activity (Rangan, 2000). Its promoters considered that convergence on development paths and modalities was unlikely between the hilly and lowland regions and so the region needed its own government.

In this context, some economic development activities led by national and state governments in the valley profoundly reshaped the morphology of the river. The most obvious ones are the creation of hydroelectric dams and related river infrastructure like concrete embankments, dikes and diversion structures. The Indian government and its administrations have promoted these techniques since the 1950s (Baghel and Nüsser, 2010). Three dams are in place in the lower

stretch of the Bhagirathi River and about thirteen run-of-the-river[86] hydroelectric projects were planned in the whole basin, as of 2007 (Theophilus, 2014). Two existing dams, Maneri Bali I and II are situated in or next to the small town of Uttarkashi, on the Bhagirathi River itself (about 130 km downstream of Gaumukh). The Tehri dam, the tallest dam in India (260 m high), lies about 60 km downstream from Uttarkashi. It was put in operation in 2006 after protests and legal actions since 1978 had delayed its construction. It entails a large disruption of the Bhagirathi River morphology and rich ecology: its 52 km^2 reservoir has created new ecological habitat conditions, upstream and downstream of the dam (GRBMP, 2013, 54).

Though a kind of 'manufactured' river as presented above, the Bhagirati River is also revered as the holy source of a Goddess, *Ganga Devi* or *Ganga Mata* (Mother Ganges) (Eck, 2012). Diana Eck reports that 'every wave' of the Ganges River is said to be a *tirtha* or a pilgrimage site (Eck, 2012, 160). The Ganges is also said to be the source of all sacred waters in India (Eck, 2012, 131; Singh, 2013). Two *tirthas* in the upper Bhagirathi valley have a particular importance for pilgrims. They are the glacier source Gaumukh and the village of Gangotri that lies about 21 km downstream, where a venerated 'embodiment of the Goddess' is brought to the main temple every summer (Drew, 2013) and brought back to lower altitudes for winters. According to epics and myths, and as is notably narrated in the *Ramayana*, the Goddess Ganga descended to earth (*gangavatara*) from heaven (Rosu, 1999; Darian, 2001). Of celestial origin, the river is said to have flowed through Shiva's hair locks to reach the earth at the particular place of Gangotri. Beyond localized sacred sites, the very water of the Ganges (*Ganga jal*) is also venerated as a highly purifying element. Hindu rituals and ceremonies are performed with Ganges waters at the river banks as well as at far distances, at local temples or at home, all over India (Rosu, 1999; Eck, 2012). Thus reverence to the river is not only performed by valley residents or pilgrims, but by all Ganges devotees across the country.

[86] A run-of-the-river hydroelectric project does not store water in a reservoir upstream of the plant but creates a headpond from which water flows are diverted through tunnels or pipes toward turbines situated at a lower level, on the side of the river. The water flows are then released back to the river at a lower stretch.

6.2.6 The Gaumukh-Uttarkashi Eco-Sensitive Zone's political process

The tense and twisted political process of the ESZ can be summarized in three chronological periods during 2004-2017: 1. Anti-dam resistance in the Bhagirathi valley manages to reach national agenda, 2. Advocacy and political negotiations lead to ESZ creation by the central government, 3. Uttarakhand state contestations bog down ESZ implementation (first the notification then the Zonal Master Plan). The next sections develop the history of the ESZ process.

Anti-Dam Resistance Reaches National Agenda (2004-2008)

The first opposition to a dam in the ESZ perimeter came through a legal procedure. It concerned the Loharinag Pala dam, a 600 megawatt run-of-the river hydroelectric dam, about 50 km downstream of Gangotri. This opposition dates back to 2005. A Gandhian organization that was locally set up during the Tehri dam struggle in the 1980's, the *Matu Jan Sangathan* (Mantu People Organization), along with two headmen of affected villages, contested the environmental clearance granted in February 2005 by the Central Ministry of Environment and Forest (MPO, 2009). The organization claimed that the environmental public hearing, organized in July 2004 by the Uttarakhand State Pollution Control Board, was conducted in violation of the 1994 Environment Impact Assessment notification, due to insufficient notice to the concerned population and absence of relevant documents, among other concerns. The activists, however, failed to overturn the decision as the National Environment Appellate Authority rejected their arguments in its order of February 2007 (Rosencranz et al., 2009). In the grievances they reiterated in 2009 in an internal report, the activists raised several issues against National Thermal Power Corporation (NTPC), the project proponent, like resettlement and land acquisition modalities, lack of local job opportunities, improper disposal of muck and excavated material within the river, as well as the issue of diversion of flow from the river into tunnels and insufficient flow downstream from the barrage (MPO, 2009). These latter issues triggered increasing local mobilizations in the years 2006-2007, largely because the access to the Bhagirathi river to perform prayers and rituals is a common concern among upstream villagers down to Uttarkashi semi-urban communities (Drew, 2017). An anti-dam front, with increased

support from outsiders, was gradually organized. An ashram, located upstream of Uttarkashi created a forum named *Ganga aahvan* or the Call (for action) of the Ganges (*Ganga aahvan* member, interview 9 September 2016). During that time, the politicization of the river, initially formulated around environmental considerations along resettlement and other socio-economic issues, was then formulated around free local access to the sacred river. Activist rhetoric was then was enlarged to comprise the protection of the entirety of Mother Ganges.

Beginning in 2007, a retired professor of Indian Institute of Technology Kanpur and former Member Secretary of the Central Pollution Control Board, G.D. Agrawal, contributed to bringing a wider publicity to the anti-dam movement. He was then chairman of the People Science Institute (PSI), which was set up in 1988 in Dehradun (Uttarakhand) by alumni of the prestigious Indian Institutes of Technology (IIT) and dedicated to development studies. Agrawal had personal connections with several environmentalist leaders and networks, like the South Asia Network on Dams, Rivers, and People (SANDRP) based in Delhi and *Tarun Bharat Sangh* in Rajasthan led by Rajendra Singh, a leading Indian advocate of water conservation (email exchanges, consulted at PSI office in September 2016). In an affidavit that Agrawal wrote in 2009 to the Uttarakhand High Court, he explained the emotional upset he felt while visiting the Uttarkashi-Gangotri stretch of the Bhagirathi valley in May 2007 after a lapse of over thirty years. Evocating the destruction of the 'majestic gurgling beauty and piety' of the river and the risk of a disappearance of 'Gangaji as we had known it' due to hydroelectric projects, he justified his commitment to undertake a 'fast unto death' for the sake of the 'cultural mother' of India (affidavit to Uttarakhand High Court 2009: 2). This decision was also linked to the announcement the same year by the Uttarakhand State of the construction of a hundred more hydroelectric projects on state rivers, notably Alaknanda and Bhagirathi Rivers (former PSI chairman, interview 16 July 2016). This news contributed to higher mobilization among existing well-connected environmentalist networks. On June 13, 2008, a day after the Maneri-Bhali II dam (304 megawatt) was inaugurated in Uttarkashi after nearly a decade of controversy about resettlement issues and lack of funds, Agrawal undertook a fast to oppose the other dams under construction in the Bhagirathi valley for the sake of the Ganges' sacredness (MPO, 2009). His action was publicized in the media and was able to reach

governmental spheres in Delhi thanks to public pressure and to personal connections among mobilized alumni of IIT Bombay including the Minister of Environment and Forests, Jairam Ramesh, from the Congress party (former PSI director, interview 16 July 2016). Moreover, the political leadership of the Hindu nationalist party, the BJP, also put its weight behind the BJP Chief Minister of Uttarakhand (interviews in Dehradun 14 July 2016 and 16 July 2016). The latter then suspended two hydropower projects of the UJVNL (a state-owned company), Pala Maneri (480 megawatt) and Bhairon Ghati (380 megawatt) dams, later in June 2008. Agrawal ended his fast on 30 June 2008 when the central government gave some assurance of reconsidering the NTPC's Loharinag Pala project (India Water Portal 2009).

Advocacy and Political Negotiations Lead to the ESZ Creation (2009-2010)

During this phase, positions, political pressures and negotiations hardened. The politicization of the river oscillated between religious references and secular ones. In continuity with the action of Prime Minister Rajiv Gandhi through the Ganga Action Plan (1986), the Congress government showed its commitment to the Ganges River in scientific and secular terms. First, there was the official recognition of the Ganges as a National River in November 2008 and the announcement of a future *National Ganga River Basin Authority* (NGRBA) (PIB, 2008). Then, Prime Minister Manmohan Singh announced the creation of the NGRBA in February 2009 (PIB 2009). Singh chaired the NGRBA, which was comprised of the Chief Ministers of the five states through which the river flows. The debates in NGRBA as well as the later formulation of the Eco-Sensitive Zone, notified in December 2012, were all dominated by scientific and secular arguments. In the meantime, alliances within the anti-dam front increased and widened with explicit support brought by several campaigning groups, like the Gandhian 'Save Ganga Movement' whose convener is based in Pune, the forum 'IITians [alumni of the Indian Institutes of Technology] for Holy Ganga', and the Matri Sadan ashram in Haridwar, while keeping the link with grassroots organizations like *Matu Jan Sangathan* and others.[87] Public interventions and campaigns through the media notably supported two more fasts from Agrawal in

[87] This information is supported by consultation of internal email exchanges (PSI Office, September 2016).

January 2009 and July 2010. He protested against the slow development from the High Level Expert Group mandated by the Power Ministry in 2008 to look into the minimum flow issue (former PSI director, interview 16 July 2016). In 2009, the Indian Council for Enviro-Legal Action also filed a petition to the Uttarakhand High Court in Nainital to request a ban on hydropower on the Gangotri-Uttarkashi stretch, arguing for protection of the biodiversity of the river (EBS 2009).

Pro-dam protagonists also raised counter-arguments. In February 2009, a lawyer and human rights activist based in Dehradun filed a case against the Uttarakhand State's decision to cancel its two projects. He denounced the detrimental consequences of these cancellations at the local level and for the state economy, as well as the safety risks posed by unfinished dams (Uttarakhand Court file 2009). In an interview, he also criticized the 'bigotry' of anti-dam activists and the related Hindu nationalist agenda (human rights activist, interview 14 July 2016). Some local pro-dam rallies took place in 2009, like the one Georgina Drew witnessed in August 2009 in Uttarkashi in which 'prominent regional and state politicians' participated. Member of Parliament and future Chief of Uttarakhand (2012-2014) Vijay Bahuguna notably raised the need of dams and development for the area in his speech at this event (Drew, 2017, 125). Hydroelectricity represents direct benefits for the state itself: hydropower companies redistribute a percentage of their annual revenues to the state and this represents a non-negligible amount for its budget.[88]

In May 2009, the Uttarakhand High Court issued its decision, ordering the temporary halt of dam construction works in the Bhagirathi valley and directing the NGRBA to take the final decision. This issue was debated at the first NGRBA meeting in October 2009. The Uttarakhand Chief Minister required compensation for electricity losses from the national level, if the suspension of the projects was confirmed (NGRBA, 2009). The central Power Ministry Secretary formally requested the continuation of the Loharinag Pala dam construction, arguing that it was nearly complete. The NGRBA's decision ordered a joint assessment report to be prepared by the ministries of Power and Environment and Forests. In 2010,

[88] The annual revenues of the suspended projects in the ESZ perimeter only would amount to 2000 crores Indian Rupees (about $250 million) per year, according to the declaration of the Uttarakhand administration at a MoEF Expert Committee meeting in 2016 (MOEF 2016). This is however plausibly much overestimated as it would represent about 5% of overall State receipts in 2016/2017 (UTK 2018).

the issue was debated among a Group of Ministers led by the Central Minister of Finance and composed by the Minister of Environment and Forests and the Minister of Power. As reported by the press, their decision was a spectacular turnaround: in July 2010, they announced the resumption of the suspended project constructions. A month later, a final decision of the cancelation of the dams and the creation of an Eco-Sensitive Zone to ban any further hydroelectric project in the area was finally publicly released by the same group of ministers. According to informants and press records, this turnaround could quite plausibly be linked to the personal decision of the Chair of the Congress Party, Sonia Gandhi (former PSI director, second interview 17 July 2016). This decision was endorsed by the NGRBA in its second meeting in November 2010. In his introductory speech, the Prime Minister used the expression of '*aviral dhara*', or continuous flow of the River Ganges (NGRBA, 2010). In doing so, he contributed to the stabilization of the 'environmental motive' defended by the anti-dam activists since 2008 -that there is a need for the 'free continuous flow' of the sacred river.

Uttarakhand State Contestations Bog Down ESZ Implementation (2011-2016)

While the anti-dam coalition seemed to have been granted its requests, in an interview one of the pro-ESZ activists referred to the ESZ process as 'sour grapes', or only deceiving outcomes (*Ganga aahvan* member, interview 9 September 2016). The overall ESZ process was delayed and undermined from 2010 onward. First, the ESZ decision was only notified in December 2012, two years after the NGRBA decision. The Environment and Forest Minister, Jairam Ramesh, finally signed it just before leaving its administration for the ministry of Rural Affairs (MoEF ESZ director, interview 1 December 2015). During the consultation, as anti-dam protagonists managed to enlarge the ESZ perimeter up to the whole watershed, the opposition of Uttarakhand State representatives only grew. The state assembly voted a resolution in March 2011 to oppose the ESZ; and in 2014, the state assembly passed a resolution to request a revision of the ESZ. Political pressures were also exerted toward the new BJP national government, in power since 2014, to obtain a revision of the ESZ. One of the requests from the Uttarakhand State was to propose a transition measure that would allow the creation of ten new hydroelectric projects up to 25 megawatts

for a total of 83 megawatts in the valley (the ESZ decision only allows mini and micro projects up to 2 megawatts) (MOEF 2016). Meanwhile, the administrative procedure was delayed.

Meetings of the ESZ monitoring committee and for the preparation of the Zonal Master Plan of the ESZ rarely took place (former PSI director, interview 16 July 2016). They were dependent on the will of State heads of administrations (Chief Secretary or District Magistrate) to organize them. A first version of the Zonal Master Plan was only produced in 2016, under legal directions from the National Green Tribunal, though it was supposed to be produced before December 2014 as per the notification rules. This Zonal Master Plan version, however, remains to be revised according to the conclusion of an Expert Group Committee (MOEF, August 2016). Local protest movements against the ESZ were organized and people boycotted the Zonal master plan consultation meetings in December 2014 (Uttarkashi District Magistrate, interview 8 September 2016). Drew documented the disillusionment of some of the local Save the Ganga campaign's initial participants (Drew, 2017). Hommes et al. (2016) also reported on the ambiguity and changes of local involvement and attitudes toward the anti-dam struggle in the Ilusu Dam case. They raised the problem of long-lasting struggles that create uncertainty for vulnerable populations. The fear of further marginalization due to the constraints posed by the ESZ on road construction, land use change, or economic activities seemed to remain a strong concern among some local people (field interviews, September 2016).

At the national level, some political struggles around the opportunity to restart the construction of the Loharinag Pala dam and other dams continued. In June 2013, a destructive flash flood occurred in the Alaknanda and Bhagirathi valleys with more than 5000 deaths and thousands of stranded pilgrims, especially in the Alaknanda valley (MoWR, 2013). The Supreme Court immediately halted construction of twenty-four hydropower projects in the two valleys and ordered a report on the cumulative impact of hydropower projects on the flood event. The report concluded that the impact of the floods was aggravated by the existing hydroelectric plants and recommended the definitive cancellation of the 24 projects (EB, 2014). However the new Minister of Environment and Forest, Prakash Javadekar, who was appointed in May 2014, contested these conclusions with the support of an internal report on the causes of the event by the Ministry

of Water Resources (MoWR, 2013). In 2016, contradictory affidavits between two central Ministries were produced to the Supreme Court. In a noticeable inversion of traditional positions, the Ministry of Water Resources and Ganges rejuvenation, led by the politician and Hindu religious figure, Uma Bharti, adopted an anti-dam stance, while the Ministry of Environment and Forest supported the hydropower projects. By 2018, these issues were still unresolved.

A Classical Environment versus Development Dispute?

The leading issue of this dispute throughout the ESZ political process was an environment versus development opposition between pro- and anti-dam coalitions. Captured through meeting minutes, affidavits, scientific reports ordered by the administration of the courts, and through media communiqués, videos, and blogs, many arguments revolved around the issue of the ecological health of the river or around the hazards in the vicinity due to the succession of dams and to the tunnels construction. Statements about how much hydropower projects contribute to development were also questioned and debates around the performance and the profitability of hydropower projects on such sediment-laden rivers were also raised. These debates proved especially difficult to resolve as often either the activists or the administration contested the data (such as the case of the 2014 Expert Body report referenced above). These scientific uncertainties, which opened space for lobbying and political interferences, played a significant role in delaying the decisions. The High Court order in May 2009 highlights this point, transferring the dam cancelation decision to the NGRBA, which, in October 2009, required a group of ministers to look at the issue with due assessment reports (EC, 2010).

However, the controversy between advocates and opponents of dams cannot be reduced to 'modernized hydropolitics versus environmental fundamentalism' (Baghel and Nüsser, 2010, 234). As argued by Baghel and Nüsser (2010), it takes place in a 'politicized environment' with multiple forms of power and knowledge relations. For example, state versus central government opposition has been instrumental in the political process of the ESZ.[89] Beyond the issues of

[89] With an ethnographical perspective on the same dispute, Georgina Drew raised another line of opposition: she reported the divisions among plain-based activists, often middle-class urban people, versus local residents or '*pahaadi*' (mountain people) (Drew 2017: 135). These observations echoed those of Amita Baviskar (2005)

the annual revenue losses of the state due to the ESZ's effect on dam cancellation, this dispute also carried a particular resonance with state/central relations as it happened less than ten years after the creation of the Uttarakhand State. As a former State Chief Secretary vehemently repeated in an interview, while mentioning the lack of consultation of the state by the central ESZ decision: 'Is India a federal State?' (former Uttarakhand Chief Secretary, interview 20 July 2016). He insisted that the state should be *the* stakeholder (his emphasis) to be consulted in such decisions as 'the State is representing the people'. He further described the dialogue with the central government in those terms: 'We raised our protests but we were not heard. So we said: "Don't assume our concurrence. We will study how any decisions will impact *our* mountains"'.[90] In this line of conflict, the politicization of the river was linked to the question of *whose* river it is, considering either the central or the state actors.

How the Sacredness of the River Intervened in the ESZ Political Process

In this 'politicized environment', the sacredness of the river also shaped the ESZ political process. The detailed sequence of the ESZ political process, as presented in the previous paragraphs, shows that the devotion to the river Ganges triggered actions from several protagonists that exerted forces in the 'strategic field of power relations'.

First, local residents who contested the dams through rallies and protests sustained their efforts because of their faith toward the Ganges and their request for a free access to the river for rituals, as reported by Drew (2017). As shown above, grassroots associations politicized this perspective of a sacred river whose holy function is to support rites and rituals. Second, the anti-dam movement that supported the ESZ decision gained direct support from Hindu religious figures and organisations. The generalist organisations joined the ones dedicated to the river Ganges like *Save the Ganga* or the forum *IITians for the Holy Ganga* through several lobbying actions. The most prominent example is the participation of the *Shankaracharya* Swaropanand Saraswati, one of the four

about tensions within the Sardar Sarovar dam struggle between local tribal people and outsider activists. However, this internal division had marginal effects on the ESZ decision process.

[90] This statement also highlights how local residents' perspectives are not perceived as directly weighting in decision processes. Here, their perspectives are seen as only to be mediated by the state representatives.

main national Hindu leaders in charge of the '*Dwarka pito'* who held a protest in Delhi on 18 June 2012 to support the anti-dam movement. He also met with the highest political figures such as the Chief Minister of Uttarakhand, the Prime Minister of India, and the Chair of Congress Party. These wider alliances were made possible when activists politicized a more general risk of the Ganges disappearance (in tunnels or because of insufficient minimum flow downstream from the dams) and subsequent loss of its self-purifying properties.[91]

Third, the fast-unto-death undertaken by G.D. Agrawal invoking his devotion to the Ganges was directly instrumental in the political fate of the decision. As described earlier, the fasting actions were highlighted in large media campaigns and triggered direct interventions from leading religious or environmentalist figures toward the national government. The first fast in June 2008 led to the suspension of the projects and to the declaration of Ganges as a National River. Agrawal's second fast in January 2009 led the government of India to accelerate the official creation of the National Ganga River Basin Authority by the Prime Minister's office in February 2009. His third fast in July-August 2010 precipitated the announcement of the second meeting of the NGRBA held in November 2010. Then his fourth fast in March 2012 again precipitated the third meeting of the NGRBA in April 2012.

Agrawal himself related his fasting action to his personal attachment and devotion to 'Mother Ganges'. Furthermore, he explicitly linked the river to the very meaning of his existence, as he stated in the affidavit to the Uttarakhand High Court:

> If these [the dams] were to be completed, there would be no Gangaji as we have known it--unless we are ready to accept either the life-less water flowing through tunnels to be Mother Gangaji, or the water-less empty channel lying like a corpse to be our identity and our cultural Mother. No, this could not simply be acceptable. I had to oppose it with what-ever options were available to me. On deep deliberations and analyses, I realized that I had but no option except staking my life itself through an indefinite 'Fast-Unto-Death'. (Affidavit 2009, 2)

[91] The stress on the Ganges' sanctity instead of its ecology was an approach that G.D. Agrawal himself considered to be more effective on government decisions (his report, India Water Portal, 2008 as underlined by Drew 2017: 131).

In this excerpt, the river meaning that is explicit is strongly linked to the Hindu tradition. In this tradition, the river is perceived as a blessing Mother and as a powerful Goddess with the power of purifying souls (Alley, 2002; Eck, 2012; Singh, 2013). There is therefore a link between people's identity and the river, as well as between individuals and the 'whole': the Ganga is a 'liquid axis mundi, a pathway connecting all spheres of reality, a presence at which or in which one may cross over to another sphere of the cosmos, ascend to heavenly worlds, or transcend human limitations' (Kinsley, 1987,193 cited by Singh, 2013). I encountered this conception of an internal and essential link between Hindus and the river again in an interview with an anti-dam activist residing in an ashram. The interviewee developed this idea in these terms: 'If the valley gets transformed, it will be a great loss. It's not about what people do but about *who we are*'. This person also later added: 'It's a spiritual cultural movement, we want to correct ourselves' (*Ganga aahvan member*, interview 9 September 2016).

The religious river meaning was already politicized during the anti-Tehri dam struggle that started in the 1980s, as reported by Sharma (2009). While demonstrating the instrumentalization of the Ganges representation for serving the Hindu nationalist agenda, Sharma showed that various dimensions of the river-human relation were then mobilized through aesthetic discourse, with pictorial and emotional significance, and mythical discourse, linking past and present and what he called 'the sense of cosmic relatedness' (Sharma, 2009, 38).

However, the effects of the actions triggered by the devotion to the Ganges were highly fragile and volatile. In the case of the Tehri dam struggle, these actions were unable to prevent the construction of the dam (Mawdsley, 2005). The ESZ story reveals how much the halting of dams and other successful moves for the anti-dam movement were dependent on strong alliances with powerful policy-makers. As shown above, the ESZ procedure could proceed when directly supported by the Prime Minister through emblematic decisions or statements. Then, the procedure became bogged down when the Congress government did not provide any more tangible sign of direct support. Three months after the 2013 Uttarakhand flood, Agrawal held a fifth fast that did not trigger any

reaction from the Congress government.[92] As a consequence, three expert members of the NGRBA resigned to protest the lack of commitment from the government. The fourth meeting of the NGRBA only took place by the end of October 2014, under the leadership of the new BJP government. The issue of the dams was then integrated in larger discussions on environmental flow and new reports and administrative assessments were ordered. As shown above, the little progress in the ESZ procedure in the years 2014-2016 was only initiated by legal actions at the National Green Tribunal, with no mention of the sacredness of the river.

6.2.7 Discussion: an 'ontological conflict' at work

In similar environmental conflicts, some analysts have stressed the growing influence of Hindu nationalist ideologies and political strategies while noting the presence of Hindu religious arguments. This is the line adopted by scholars such as Mawdsley (2005) and Sharma (2009) who have studied the mobilization of the sacredness of the Ganges River in the Tehri dam struggle that began in the 1980s. Both authors highlighted the manipulation of Hindu symbols, myths, and spiritual elements in environmentalist campaigns that gradually served to promote a Hindu communal and exclusionary agenda. Mukul Sharma also emphasized the connection made between the Ganges and the idea of national unity (Sharma, 2009, 38). The 'instrumentalist' mobilization of the Ganges' religious symbol by Hindu nationalists can be traced back to 1983, during the *Ekamatra Yatra* (the pilgrimage of the Unity of Mother [India]) organized by the Hindu nationalist organization *Vishva Hindu Parishad*, where Ganges water was distributed (Jaffrelot, 1993, 430-431). In the ESZ story, the Congress party also manifestly supported the 'pro-Ganga' movement in the years 2008-2010. In addition to the expressed environmental concerns, this political move could also be related to the presence of a Hindu traditionalist fraction in the party as well as to a more global 'erosion of the secularist vigilance' since the 1980s to gain votes (Jaffrelot, 1993, 437, 483).

[92] Agrawal again went on indefinite fast for the river again in June 2018. He notably requested from the BJP government a Ganga Protection Management Act to be enacted and a definitive ban on hydropower along the tributaries of the Ganges. He died on 12 October 2018 due to his fast (Nawaz, 2018).

If this partisan dimension cannot be dismissed in the ESZ conflict, then another layer—the ontological dimension of the case—must also be considered, which takes seriously the role of the river-human relation in the river politicization, drawing from de la Cadena's work and inspired by Berque's conceptualization of *mésologie*. In her work on sacred mountains in the Andes and their '[breaking] into political stages', Marisol de la Cadena showed how an environmental struggle against a mining concession project witnessed what she termed 'more than politics as usual' (de la Cadena, 2010, 342, 339) because of the introduction of an indigenous 'earth-being' into classical politics. She highlighted that 'earth-practices are relations for which the dominant ontological distinction between humans and nature does not work' (de la Cadena, 2010, 343). There is, of course, a sharp contrast between the Andean context of historically dismissed indigenous practices and the Indian context of dominant Hindu practices. However, the politicization of the Ganges as a sacred being in the ESZ political process calls for such scholarly attention too.

Statements about the river-human relation strongly refer to the ontological question of 'what the Ganges River is'. In what may be called the 'Hindu religious perspective', the river *is* both a material river *and* a Goddess. The anti-dam 'religious perspective' relies on an ontology which does not consider the river as an object. Furthermore, the perspective does not neatly separate humans from the river. As stated by an anti-dam activist, the relation to the river involves questions about 'who we are', or as stated by Agrawal, 'our very identity' (affidavit to Uttarakhand High Court 2009: 2). With its purifying power, the river transforms humans. This is corroborated by Singh's explanation of Hindu pilgrimage: 'In Hindu lifeworld, pilgrimage is an act to cross (i.e. *tirthayatra*), and to cross is to be transformed' (Singh, 2011, 27). This singularly echoes the way Augustin Berque conceptualized the milieu, as both the environment and the human's interpretation of it. The milieu is present in the humans and reciprocally, through '*trajection*' processes or iterative transformations. This perspective, according to Berque, breaks the 'classical modern western paradigm' of the object-subject divide (Berque, 2014).

In contrast, the river is perceived as an external and material entity for the

hydropower proponents.[93] The river is understood as a resource to be exploited, 'unless it is wasted into the sea' as formulated by a pro-dam activist (RLEK chairman, interview 14 July 2016). The Khosla expert committee involved in the development of Narmada river valley already used these exact terms in 1965 (cited by Baghel 2014, 12). In his study of river control in India, Baghel (2014) points to the prevalence of the idea of rivers being 'wasted water' in contemporary governmental rationalities. More generally, this idea also refers to 'modern hydrology' that belongs to the wider modernization project. In post-independent India, modern science was understood as the tool to build a modern nation that would be freed from poverty and from superstition: 'the move away from sacred rivers, towards dams as temples, in order to create a "modern" India was perhaps inevitable' (Baghel, 2014, 72). As an echo of this vision, a pro-dam activist explicitly denounced the 'pressure of various religious groups' on the state government in its petition to court denouncing the suspension of the Pala Maneri and Bhairon Ghati projects (COMPELO, 2009).

The ESZ dispute may thus embed an 'ontological conflict', or a conflict 'involving different assumptions about "what exists"' (Blaser, 2013, 547). In an interview about the ESZ struggle, an anti-dam activist even explicitly noted, 'this is a question of ontology' (*Ganga aahvan* member, interview 9 September 2016). Instead of reducing the religious perspective of the river to a mere discursive strategy of one side of the political struggle, the deep significance of this 'other' ontology of the river is what motivated some actors to take action.[94] For example, Agrawal reiterated statements on his will to engage his life for the Ganges River. Another activist explained that she gave up having children because of her full-time involvement in the struggle. Other actors involved in the ESZ dispute invested significant amounts of time and effort in the name of their devotion to

[93] Some ecologists strongly involved in the ESZ dispute within the anti-dam movement also share this perspective. In interviews, they manifest some distance with the religious meaning of the river and prefer to insist on the ecological and social dimensions of the river. This view is somehow expressed in the Delhi Declaration for Rivers, issued in 2014 by a group of environmentalist NGOs, stating that a river has to be protected for its ecology or for the services it provides to humans (Peace Institute Charitable Trust Publishers, 2014: 5). However, science-based environmental and religious forms of activism are not necessarily opposed. There are several people whose beliefs accommodate both perspectives without experiencing any contradiction, such as G.D. Agrawal himself.

[94] This is however not a necessary condition: some ecologists, lawyers, etc. also invested time and efforts in the anti-dam struggle without being moved by a religious motive.

the river (Drew, 2017). Furthermore, this 'other' ontology is both apprehended by the mind and also related to an individual, bodily and emotional experience that may be perpetuated by religious practices. Agrawal mentioned the deep emotion that seized him when he saw the transformed Bhagirathi valley in 2007 and that triggered his first fasting action. Drew's ethnographic study showed how much the bodily performance of devotional songs or other 'everyday interactions and connections with the divine entity [solidify] the means and manners in which the river obtains its deepest significances' (Drew, 2017, 16-17). Those everyday interactions are not restricted to riverbank residents but any Hindu devotees who perform prayers, songs or rituals in relation to the river Ganges in their home, on river banks or in temples. As a consequence, they also infuse Hindu figures from further locations and contribute to what Singh named the 'self-amplifying interactions between people and their landscape' (Singh, 2011, 26), whether physical or metaphoric ones.

6.2.8 Conclusion

The presence of at least two conflicting paradigms about 'what is the River Ganges' impregnated the ESZ dispute. In line with the 'political ontology' project (Blaser 2013) and with the hydrosocial theoretical approach, ontological dimensions should be investigated in analyses that aim to decipher internalization of politics and power relations in nature-society coproduction.

Blaser emphasized that attention to the ontological dimension of a conflict is not meant to help a researcher get closer to a supposed external reality but rather to help capture the effectiveness of this 'way of wording' (Blaser, 2013, 551). In this regard, the distinct line of river politicization has already produced some effects on the Indian environmental policy framework. Three texts could be interpreted as 'ways of inscribing' the 'other' ontology of the river in the policy and legal frame of the country: first, the 2008 National River declaration from former Prime Minister Manmohan Singh, which stresses the specificity of the Ganges; second, launched in 2014 by Prime Minister Narendra Modi's government, the *Namami Gange Programe* which took over the National Mission Clean Ganga with a deliberate reference to the holiness of the river; third, the draft 'Ganga Law', which has no equivalent for other rivers in India and that was under consideration in July 2017 by the Ministry of Water Resources. More

strikingly, the March 2017 Uttarakhand Court decision of conferring the status of 'legal and living entities' to the Ganges River and to the Yamuna River, one of Ganges' tributaries, gave explicit support to the interpretation of these rivers as not being mere objects. Notably, to support its argument, this 2017 decision referred to a precedent case involving a Hindu idol, thus signifying the religious significance of the Ganges.

In reviewing the story of the Gaumukh-Uttarkashi Eco-Sensitive Zone, I have shown how the sacredness of the river intervened in the decision's political fate, among other strong debates and various political strategies. The effects, however, have been volatile. They were dependent on alliances with powerful policy-makers and on actions to courts. This confirms the volatility of such politicization processes already described by scholars in the Indian context (Alley, 2002; Mawdsley, 2005). Emma Tomalin documented how the idea of the need of a total transformation of human/nature relation to reach ecological sustainability emerged among what she termed a 'global religious environmentalism' (Tomalin, 2002). In this regard, the ESZ case confirms the potential of political resistance led by an 'other' ontological perspective. However, the case also highlights how the actual mediation that complex political realms play in the environmental decision-making processes contradicts the idea of a supposed causality between a renewed human/nature relation and sustainable decisions.

CHAPTER 7: CONCLUSION

This conclusion aims to recollect the findings of my doctoral work in regard to the theoretical and empirical research questions. It highlights the connections among the cases to produce a detailed reflection on 'river meaning'. It proposes to consider the latter notion as an analytical tool to be further mobilized within hydrosocial analyses in river contexts. The conclusion finally provides some way forward for future research as well as some recommendations for policy-makers.

7.1 INTRODUCTION

This doctoral work confirmed the analytical power of political ecology approaches, in particular the hydrosocial framework, for the investigation of spatially and temporally contrasted policy narratives about the Ganges River in India. These investigations produced separately the following main findings:

1. The *Namami Gange* programme, launched in 2014, politicizes River Ganges' holiness and stands apparently in rupture with previous policies towards the river. This approach however conceptualizes the River Ganges as a 'nationalized environment', in continuity with post-independent approaches to the river. The programme mainly consists of actions that fight river pollution, as the goal of cleaning the Ganges became subordinated to the Hindu nationalist ideology of saving the nation's culture and spirituality. As a consequence, the programme does not address the pressing surface water depletion that happens in non-monsoon periods.
2. Colonial and post-colonial treatments of the Ganges delta are infused with a hegemonic land/water conceptual divide that affected waterscapes as well as riverine lives and livelihoods. Sediment issues and 'muddyscapes' were downplayed.
3. The sacredness of the source of the Ganges played a role in the political fate of the *Gaumukh-Uttarkashi Eco-Sensitive Zone* (ESZ) decision, gazetted in 2012. Some of the actors' motivations and political strategies derived from the

formulation of a different ontology of the river, in which the River and the Humans are intrinsically connected.
These three narratives demonstrate the critical role of 'river meanings' or river conceptualizations[95] within decision processes that shape the river basin and related lives on the ground. Further commonalities of the cases are developed in this conclusion, in order to answer the initial research questions.

The conclusion consists of four sections. Section 7.2 addresses the initial theoretical question or how to refine the hydrosocial framework in river context. It also highlights the analytical potential of the 'river meaning' notion. In section 7.3, further insights on the empirical sub-question A3[96] are drawn from the theoretical conclusions developed in section 7.2. Section 7.4 suggests further lines of research inquiries. Finally, section 7.5 present some loose recommendations for policy-makers that I draw from the theoretical and empirical investigations conducted since 2015.

The initial questions are again presented here as a reminder:

A. How does Ganges 'rejuvenation' emerge as a problem to be addressed by public action?

A1. How has the Ganges been identified as an object of public intervention?

A2. How has the Ganges 'problem' been made visible?

A3. In this historical and gradual process of political and ecological redefinitions of the river, what 'river meanings' are politicized, what 'river meanings' remain unaddressed?

B. How to mobilize and further define the hydrosocial approach in river contexts?

B1. How does the materiality of a river -that is not restricted to water flows- intervene in the hydrosocial cycle?

[95] See the initial definition of 'river meaning' on page 19.

[96] The sub-question A3 is typical of the way political ecology frames research question (Turner and Robbins, 2008): 'in this historical and gradual process of political and ecological redefinitions of the river, what 'river meanings' are politicized, what 'river meanings' remain unaddressed?'. As shown in section 7.3, the theoretical reflections that are developed in section 7.2 are mobilized to address it.

B2. How do emotional and symbolic attachments towards a river intervene in the hydrosocial cycle?

B3. How to further define the nature, roles and politics of 'river meanings' in the hydrosocial cycle framework?

7.2 THEORETICAL AND ANALYTICAL CONTRIBUTIONS

7.2.1 Advancing the hydrosocial framework in river context

This doctoral work proposed to advance the hydrosocial framework in the context of rivers through the mobilization of *mésologie* on one hand (Chapters Four and Six), and with some insights about the attention to materiality from critical physical geography, on the other hand (Chapter Five). It further explored three domains: the material heterogeneity of rivers, the geo-historicized and bodily river-human relation and its ontological dimension. The reflections that I conducted in Chapter Four highlighted first, the differences among the categories 'river' and 'water'; second, the paradigm shift that has occurred since the early eighties with the Actor-Network Theory and other non-modern ontologies (Braun, 2008) that contest the object-subject divide. These developments were possible thanks to a detailed reflection on 'what is a river', pursuing the reflections of Jamie Linton in his book 'What is water? The History of a Modern Abstraction' (Linton, 2010). I also later drew inspiration from Kuntala Lahiri-Dutt's paper 'Imagining Rivers' (Lahiri-Dutt, 2000). Both authors make us aware that water – and rivers- are more than natural element or phenomenon, they are also constructed categories. To initiate this analysis, I chose to investigate the various perspectives of a river that knowledge-holders then scientists have promoted over time, as instances of river categories. Rivers are flows of water (hydrology, hydrogeology) but they also carriers of sediments (sedimentology, physical geography) and biological elements (hydrobiology). They are ecosystems driven by biotic and abiotic components' interactions (ecology). Rivers are also landscapes (the channel delimited by the running waters) with their annexes (active tributaries, distributaries, abandoned channels, etc.) and their floodplains (hydrography, geography). They are geographical inscriptions on the Earth's surface in contrast to the abstraction 'water'. Their materiality is heterogeneous.

As a consequence, mobilizing the hydrosocial framework in river context implies to take seriously these physical attributes of a river. In addition, Linton and Lahiri-Dutt also point to the role of discourses and categories, often framed by modern science, within state interventions. Lahiri-Dutt in particular refers to the Indian context where rivers are culturally more than an object -while modern science objectifies them. Strang (2004, 246) also underlines that the *de-materialisation* of water that is treated as a commodity, is also 'a *de-socialisation* that denies the reality of local, specific human–environmental relationships'.

In a first step I proposed to incorporate one dimension of the material heterogeneity of rivers within the hydrosocial cycle framework. In that regard, my co-authors and I proposed a 'sediment-enriched hydrosocial cycle'[97] in order to more adequately capture the water-sediment-society dynamics encountered in the Gangetic delta (see Chapter Five). These dynamics remain often unexplored because of the predominance of a land/water conceptual divide in river management paradigms. The focus on the sediment load of rivers led us to mobilize detailed insights from the natural sciences on sediment characteristics and dynamics in the Ganges lower basin, inspired by critical physical geography (Lave and al., 2015). Reflecting on the roles and meanings of sediments confirmed the relevance of paying better attention to materiality over space and time in the political ecology of water approach (Birkenholtz, 2016). It also reinforces the dialectical thinking adopted in the hydrosocial cycle concept that emphasizes processes and relations instead of fixed things and categories (Harvey, 1996; Linton and Budds, 2014).

The second dimension that I chose to advance in the hydrosocial framework is the conceptual attention to the geographical, historicized and bodily river-human relation. The hydrosocial cycle framework emphasizes the *dialectical* and *internal* relation between water and society, endorsing the idea of co-constituting materialities and social constructions that form changing sets of hybrid socio-natures (Swyngedouw, 1999; Linton and Budds, 2014). My work developed this understanding in considering the river-society relation as an instance of 'milieu', according to the Berque's conceptualization of *mésologie* (Chapters Four and

[97] See Figure 12 page 115.

Six). The hydrosocial framework and *mésologie* share some important commonalities: they both conceptualize the river (water)-society relation as internal; they also refer to the 'experiential, cultural and metaphorical ways' of connecting to water or to the 'milieu' (Linton and Budds, 2014, 174; Berque, 2014). However, the concept of milieu has a geographical emphasis that is tuned to the geographical attribute of a river. It refers to a human-environment relation, with the environment being the initially given surrounding geographical space in which human activities occur. As presented in Chapter Four, the milieu is simultaneously the given environment and the human interpretation of it. The concept of 'trajection' refers to a reciprocal, recursive and historicized transformation of both poles of the milieu that is therefore not an entirely objective, nor an entirely subjective reality. The milieu becomes more and more human with the successive transformations produced by iterative interpretations of it, producing 'trajective chains' that embed historical-geographical trajectories (Berque, 2014). Conversely, Berque emphasizes the transformation of the human beings, as they carry both an animal body and a 'medial body' that incorporates the historicized milieu. The attention of *mésologie* to the individual and bodily interpretation processes through 'senses, action, thought, and language' is particularly tuned to a context in which rivers are culturally revered for millennia [98]. They remain also part of the existences of contemporary devotees[99]. However, the concept of milieu is not restricted to such particular contexts in which the river-human relation has been actively sustained over time by myths, religious writings and rituals. Heritage approaches to river valleys in Europe for example, are contemporary efforts to revive attachments to rivers, i.e physical as well as metaphorical, collective as well as individual, interactions with rivers. They are one contemporary pattern (or a 'hydrosocial cycle moment' as termed in Chapter Five) within the long-term history of these *milieux*.

Developing a political ontology approach is the third proposed analytical refinement of the hydrosocial cycle framework. Ontology refers here to the question of 'what is a river?' (an object? more than an object?). The attention to ontology is already present in the framework as it emphasizes the internalization of social relations within the nature of water (Linton and Budds, 2014, 179).

[98] See Chapter Two.

[99] See Chapter Five, as well as Appendix 3 (text *River-house, river-home*).

Chapter Six further exploited the rupture of the object/subject divide in the analysis, in line with *mésologie*'s conceptualization of the human-environment relation. Empirically, the analysis captured the presence of an 'ontological conflict' in the *Gaumukh-Uttarkashi Eco-Sensitive Zone* struggle, with divergent understandings of the river's ontology. In addition, in that case, river's ontology was not only about the question 'what is the river?' but also 'what are human people?'. We argue that the ontological distinctions of the river become significant and the source of a conflict in that they refer to the internal links between the river and the very meaning of human existence. For instance, the pilgrimage function at river banks is for souls to 'cross over' to the divine realm, thus transforming themselves (Chapter Two, 2.2.1). As also mentioned in Chapter Two, there is a high resonance for Hindus between the river and life and death. Particularly, death and cremation rituals on the banks of the Ganges in Varanasi are praised as they may secure soul's salvation. Finally, the case proved the analytical potential of investigating the effectiveness of an ontological stand once turned into a 'way of wording' in governance practices and policy formulation (Blaser, 2013). Chapter Six showed some effects on the Indian environmental policy framework of the politicization of a religious perspective that supports a different ontology of the River. It drew attention to the expressed internal connection between the Ganges River and the devotees' existence that was finally inscribed to some extent within policy and legal decisions.

7.2.2 Mobilizing 'river meaning' for governance analysis

These investigations confirm the strength of the 'water meaning' notion, drawn from the works from Strang (2004) and Linton and Budds (2014): 'water takes on meanings by virtue of its social circumstances, while people's interactions with meaning-full water also co-constitute human identities and imaginaries' (Linton and Budds, 2014, 174). Strang also underlines 'the importance of material qualities and physical, sensory and affective experience in the generation of meaning' (2004, 245).

Further to some developments presented in Chapter Six and to the reflections presented above, I propose to precisely define the notion of *river meaning* in the following terms:

In a specific river context, this is a strategic[100] interpretation of 'what the river is', encompassing sensitive, emotional, experienced, cultural and metaphorical dimensions of the human-river relation.

Its analytical power is stronger than more general notions that are often mobilized to deal with contexts where different cultural perspectives are at stake[101]: on the one hand, it incorporates specific perspectives and knowledge on rivers that can vary with greater nuances than broad cultural frames (see for instance, the 'third way' of some environmentalists in the ESZ struggle, who call for greater reverence for rivers without endorsing the Hindu religious perspective of rivers as Goddesses), and notably at local scales (see for example, the expressed divide between 'hilly' people and people from the plains that Drew recorded in her ethnographical account of the ESZ struggle around Uttarkashi town (Drew, 2017)); on the other hand, it encompasses the bodily dimensions of the river-human interactions (Chapter Six).

The river meaning also incorporates the goal-oriented definition of 'what the river should be' or 'requires', for a single actor or for a group of actors. This approach draws from the 'referential' concept (Muller, 2013). Analyzing a river meaning is to make its 'purpose' explicit, or the effectiveness of its 'way of wording', as termed by Blaser (2013). This concurs to the work of Gabrielle Bouleau, who chose the term 'environmental motive' to refer simultaneously to the pattern and to the purpose of such a 'perceived representation' (Bouleau, 2017). A river meaning can be politicized (i.e. transferred, through various communication processes, into more generalized political debates and into actions of negotiation, see Chapter Six) but can also remain 'inactivated' within political spheres. The latter case is illustrated in the cases in the Ganges delta (Chapter Five), where the religious meaning of the Ganges River remained absent from the debates[102].

[100] In the sense of a 'towards a goal-oriented' understanding.

[101] Such as the notion of worldview, for instance.

[102] The following assumptions may explain this absence: the cultural and historical backdrop of Bengal is largely different from Garhwal (Uttarakhand) and Ganges main plains, with for instance several centuries of Muslim rulers (Sultanate of Bengal in medieval period); the physical distance to the Tehri Dam struggle and to the ESZ dispute, where myths about the Ganges were revived and politicized, as described in Chapter Six; the emphasis in these politicizations on the Himalayan origin, as highlighted by (Sharma, 2009), rather than on the delta, as the former presents many links with mythological texts.

Chapter Three also showed how the Ganges' environmental problem got politicized through partisan reactivations of a national symbol. A river meaning can be shared among riverine communities as well as by communities living far away from the river (Chapter Five), as it encompasses cognitive and metaphorical components. It can therefore put people into action from various circles, at different scales. These people may only partially share the politicized river meanings, with more or less awareness of these gaps; this happened during the ESZ political struggle among the Uttarkashi residents, as documented by Drew (2017) or among the Congress' political figures, who finally deceived the anti-dam activists. Conversely, some actors' moves may aim at countering these river meaning politicizations: in March 2016, the chief priest of Mankameshwar temple in Lucknow (Uttar Pradesh), a woman priest, broke a 700-year old tradition in using water from the local River instead of Ganges water on the occasion of Mahashivratri festival, in order to 'spread the message of the conservation of all rivers'[103].

I therefore argue that river meanings are 'mobile and transformable', as one component of the hydrosocial cycle that shapes and is shaped by other components of the cycle, such as power relations, use and exchange patterns, or physical processes mediated by infrastructure (Chapter 4). This however contrasts with the conclusion of Strang in her detailed ethnographical accounts of water meanings among water users of the Stour valley in Dorset, UK, of 'enormous emotional and intellectual consistency' of water meanings (2004, 245). Further to the mésologie's insights on the reciprocal river-human relation, I would assume that river meanings are long lasting, with longer time frames than policy decisions or infrastructure development, but not immutable. The river meaning concept makes thus possible to analytically distinguish the changes and the absence of change in ruling paradigms that drive river management actions.

Finally, river meanings may also simultaneously relate to various levels of reality, according to gradual interpretation levels: confined to visual descriptions or scientifically measured indicators (for which language and categories however already introduce some interpretation processes) or related to 'non-modern'

[103] Business Standard, 7 March 2016.

ontological perspectives. In the 'River-house, river-home' text published in *Voices from around the world* (2017), I proposed another illustration of this idea of various levels of reality in river meanings, in referring to river-house and river-home perspectives (Appendix 2). As a consequence, we could imagine a plurality of simultaneous socio-natures around a same river and conceive them as plural hydro(river)social cycles that would not interact one with another, with their own feedback loops. They would only meet in some points, and then shaping each other, when a contingent event force them to, such as a announcement of the creation of a dam (Chapter Six), or a series of floods that ruin agricultural land (Chapter Five). River meaning as an analytical tool thus helps to decipher underpinning conflicting perspectives that contribute to somehow inextricable environment-development struggle, in clarifying the nature and politicized forms of the river meanings. It would thus prove useful to characterize and analyze governance processes in relation with rivers.

How to address the plurality of river meanings in river governance processes? The plural dimensions of river meanings lead necessarily to difficult or even perverted translations into the policy spheres of river management, as showed in several works in the political ecology of water (Chapter Four). The above theoretical considerations on river meanings call for finely tuned governance systems that can adjust to the complexity of this plurality. To go beyond the common recognition of this need, I propose here three lines of inquiries that aim to guide reflections about 'appropriate' (i.e., in the political ecology perspective, socially and environmentally just) river governance processes.

1. <u>Recognizing the agency of a river:</u> which actor/group of actors 'speaks for the river' in decision-making processes? How did they build their legitimacy? Can this legitimacy be strengthened by guaranteeing other engaged actors' feedback loops in the decision process?
2. <u>Recognizing the geographical, historicized and bodily human-river relation:</u> In a specific context, what are the operating local and global interpretations of the river? To whom does the governance system or the decision give credit? What are the consequences for those human-river relations that are put aside? How to give back some space for them or how

to define legitimate compensation or accompanying measures, at adequate scale?

3. Recognizing a river as a not entirely objective, nor entirely subjective reality: which actors/groups of actors are legitimate to sit at the governance table? How to represent the non-vocal actors that still interact with the river? If we affect what we are, while affecting the river, how to ensure reversible measures, spatially and temporally? How to design a legitimate and sustained process to play the role of safeguarding the reversibility of decisions, initially, during and after implementation?

This section worked at further defining the notion of 'river meanings', as it may support better analyses of governance and political processes in river contexts. The section also linked the theoretical reflections of this research with some guidance for more socially just governance processes. The recommendations for policy-makers in the section 7.5 are also a loose attempt to tackle this question in the specific context of the Ganges River[104].

7.3 EMPIRICAL CONTRIBUTIONS

The investigation of the physical and sacred geographies of the Ganges (Chapter Two) showed how much this river offers an archetype of tangible and sustained river-human relations. The Ganges is a large and highly populated river basin with a noticeable heterogeneity between the Himalayan regions, the central plains and the delta, and among seasons, due to the monsoon regime that also contribute to the heavy load of sediments carried by the river flows. The river is however represented as as single entity, a Goddess, in the Hindu perspective, with limited reference to the material characteristics of the river. As presented in Chapter 2 on Indian sacred geography, Diana Eck (2012) and other authors characterized how much the human-river relation has been supported over centuries by mythology, religious texts and exegesis, as well as ritual practices that are still widely performed, with amplified effects such as today's mass

[104] In the following lines, I also make use of my professional experience as a former civil servant involved in flood management and river/lagoon restoration programmes at watershed, regional and national levels in France, in the 2000's.

participation to pilgrimages and to auspicious ceremonies on the river banks. I showed how the ideas of a two-way, reciprocal and internal relationship between the river and the humans have been expressed by some devotees of the Ganges, echoing terms similar to those of *mésologie*[105]. I therefore was able to develop several lines of theoretical inquiry within the hydrosocial framework, thanks to the mobilization of the Ganges case. Conversely, these theoretical reflections are now mobilized to finalizing the empirical contributions of this doctoral work. In what follows, I make explicit the river meanings that were politicized by the Central government in the move of the *Namami Gange* programme and the river meanings that were left inactivated.

In chapter Three, I investigated the framing of 'the environmental problem' of the River Ganges at the national level. The goal of the analysis, typical of post-structural political ecology, was to critically interrogate the unquestioned dimensions of a constructed environmental problem. As many works in political ecology show, environmental policies that are founded on unquestioned problems, are designed with blind spots that may entail further social and environmental inequities (Robbins, 2012). I proposed to scrutinize Ganges river meanings at multiple spatial and temporal scales in response to this initial question. I particularly studied some of their politicizations and their consequent roles in national and sub-national political processes. First, I presented a history of the emergence, stabilization, and transformation of the Ganges' environmental 'problem' over the last forty years, in relation to national policies about the Ganges (Chapter Three). I highlighted how the 'Ganges problem' gradually shifted from the need to clean a river to the need to save a landscape, a culture, a spirituality and a nation. Second, I zoomed in the Ganges delta (West Bengal) and we, along with my co-authors, showed how a land/water divide has infused ruling paradigms towards the River since colonial times, masking the importance of river-sediment-people dynamics (Chapter Five). The narrative also presented contemporary resistance moves against the dominant river meaning unable to

[105] In her book, Drew emphasized the idea collected among some devotees that the river was brought to earth thanks to human intervention, through a unique agreement among Gods and humans (2017, 44; see also the tale of King Bhagirathi's penance in Chapter Two). This idea of the co-creation of a sacred River that purifies human souls and supports them to 'cross over' to the divine realm thanks to performed rituals is a striking representation of a kind of trajective relation.

deal with 'chars' as they are land(water)scapes. Third, I zoomed in the Ganges headwaters region in Uttarakhand State, where I showed how the religious perspective of the River, which attributes a distinct ontology to the Ganges, contributed to shape a 2012 policy decision, the *Gaumukh-Uttarkashi Eco-Sensitive Zone* (ESZ) and further national frames (Chapter Six).

My headwaters and delta case studies proved useful to capture some of the commonalities and contrasts between national and sub-national politicizations of the Ganges River. In the ESZ case, the Ganges River was mainly politicized as a whole, as a Goddess or as a national symbol, while that line of politicization appeared absent from the local debates that I recorded in the Ganges delta: issues evolved there around local or sub-regional sedimentation or erosion phenomena. In some of my interactions in the field, I was spontaneously told about *Swachh Bharat* national programme, i.e. the programme launched by Prime Minister Narendra Modi to encourage sanitation coverage, but not about *Namami Gange* programme[106]. This observation concurs to the findings of the Chapter Three, which showed that the *Namami Gange* programme mainly carried a Central State perspective of the River. In continuity with previous approaches of river management in India, the river meaning underpinning the programme referred to the Ganges River as a 'nationalized environment', as termed by Baghel in the Indian context of river control policies (2014) (see Chapter Three).

The *Namami Gange* programme can be seen as a symptom of a referential change in environmental policy in India (Chapter Three) but it also presents a strong continuity with previous approaches. In particular, questions related to reforms in governance processes, towards more decentralized and accountable approaches, remained unaddressed. In addition, the political instrumentalization of the holiness of the river in the programme created some dissonances when contradictory decisions were taken, such as the support to pursue hydropower development in the Ganges headwaters by the Central Environment Minister in 2016-2017. Finally, the focus on the Hindu religious perspective of the river entailed less emphasis on the river meanings considering the Ganges River as a

[106] I however usually questioned my interlocutors in the administrations about the *Namami Gange* programme, but I recorded little profound discussion about it. In one instance, in response to my question the District Magistrate of Malda district largely instead discussed the West Bengal's '*Nirmal Bangla*' programme.

provider of ecosystem services for humans, or as a threat. This led to under-politicized health, resource quantity and flood vulnerability issues by central authorities. These sensitive and complex issues are however crucial for the daily lives of millions of riverine residents but they remain under-documented[107] and their governance modalities unreformed. In that sense, the *Namami Gange* case seems to provide a counterexample where the attention to the cultural and ontological values of the river is socially counterproductive as it diverts the authorities' efforts, first, from precisely documenting the social impacts of the environmental condition of the river, second from questioning the representativeness and legitimacy of the policy priorities. This is in a way illustrated by the groundbreaking 2017 Uttarakhand court decision that conferred to the Ganges and the Yamuna rivers and their tributaries, the status of 'juristic/legal persons/living entities'. I showed in Chapter Six how this decision could be linked to the inscription of another ontology in national frameworks. However, the decision abruptly ends with the designation of the three persons in charge of representing the rivers (declared as 'persons in loco parentis' or 'in the place of a parent'), these three persons being the Director of *Namami Gange*, the Chief Secretary of the State of Uttarakhand and the Advocate General of the State of Uttarakhand, without elaborating nor justifying the reasons of that choice (Uttarakhand High Court, March 2017). This move illustrates that the legitimacy of these authorities to 'speak for the river', as raised in section 7.2, remains unquestioned[108]. Further to this observation, and as an attempt to translate the theoretical outcomes of this doctoral thesis in propositions for changed approach to governance of the Ganges, I will loosely draw some recommendations for policy-makers in section 7.5.

7.4 FUTURE LINES OF RESEARCH

[107] This was already the case in the Ganga River Basin Management Plan (2015) elaborated by a consortium of seven Indian Institutes of Technology (IITs). There is a striking lack of data related to the social impacts of the environmental condition of the Ganges in these more than fifty reports.

[108] A recent initiative of environmentalists to propose an alternate 'People's Ganga Bill' against the draft National River Ganga (Rejuvenation, Protection, Management) Bill prepared by the Central government, illustrates a form of resistance move to that situation (press report, December 2018). See https://www.downtoearth.org.in/news/water/for-free-flow-ganga-gets-a-plethora-of-regulations-62540.

This doctoral work showed the relevance of the hydrosocial framework to analyse policy narratives in the context of rivers. The reflections on the nature and analytical roles of the 'river meaning' concept would benefit from being further developed in the particular context of floods. Floods are "socionatures" (Ranganathan, 2015) that may internalize uneven distribution of social costs (Pelling, 1999; Middleton et al., 2017). In this regard, in 2017, I led the development of a collective research project for a European-India research grant to study flood governance processes in relation to water paradigms in Ganges and Rhone basins (India, Switzerland, France). This work will notably aim to apply and test the sediment-enriched 'hydrosocial cycle' presented in Chapter Five and developed in the highly silted lower Ganges, in the Rhone basin. This framework will be applied both in a mountain floodplain and delta contexts, in order to strengthen it or to reframe it[109].

A second line of research inspired by this doctoral work could push forward the reflections on how to account for religious and spiritual interpretations of the 'milieu' within a 'mésologie' framework. We illustrated in Chapter Six around the Gaumukh-Uttarkashi Eco-Sensitive Zone conflict that these interpretations may produce forms of actions or resistance within socio-political processes. Two types of difficulty must be thus handled in such a context. One is to insert conflictive interpretations, such as for example, a religious one versus an atheist one, within 'trajective chains' (in Berque's term, the iterative processes of 'milieu' interpretations), at a conceptual level. The plurality of human interpretations that may oppose each other is not addressed as such in Berque's theory, which instead refers to evolution processes with humans taken as a global entity (Berque, 2018). In my sense, this relates to a second difficulty, a methodological one. How to account for collective and individual perspectives that both play critical roles in religious or faith-based interpretations of 'nature' within the cases? How to bridge them, how to account for their interactions in the analyses? As a first answer, my work tended to account for what could be observable within available sources, privileging substantive contents: discourses, mainly

[109] This funding application was successful in 2018 under the EqUIP joint call for proposals under the theme 'Sustainability, equity, wellbeing and cultural connections'. EqUIP is a research collaboration platform between India and the European Union specifically dedicated to the social sciences and humanities. The principal investigators of the research project are. Professor René Véron (UNIL, Switzerland), Dr. Jenia Mukherjee (IIT Kharagpur, India) and Dr. Joana Guerrin (Université de Nîmes, France).

written ones, from various sources (affidavits, press releases, email exchanges, etc.). I could however not develop a methodological enquiry about general criteria for selecting adequate sources, their structuration and prioritisation, using relevant literature. This could be developed in the future as a specific methodological research question.

A third line of research could explore insights from heritage approaches in river valley contexts to enrich our reflections on river meanings about attachments. Barraud and Germaine (2017) confirm the significance of attachments to riverscapes and river uses in controversies evolving around the dismantlement of small dams to improve river ecological continuum. The explorations of commonalities and differences between faith-based attachments to a river and 'attachments to spaces' as termed by Barraud and Germaine ('*attachements aux lieux*'), through the comparison of case studies addressed with similar methodologies, would provide the opportunity to better characterize the specificity of the faith-based dimension. Further political ecology-inspired investigations should also address contexts where nature is revered. In the Gaumukh-Uttarkashi Eco-Sensitive Zone case (Chapter Six), I concluded that the presence of 'another ontology' linked to the religious veneration of the river did not decisively influence the political processes. Other contexts could however reveal how attachments to sacred landscapes may inspire renewed modes of political mobilization and action, with greater effects on public decisions.

7.5 RECOMMENDATIONS FOR POLICY-MAKERS

In this final section, I mix theoretical and empirical insights from my research work during 2015-2019 and some reflections drawn from my professional experience. I cumulate experience in water management in France, as a public officer (1999-2010) and in India, as a foreign partner and observer (2010-2014) or consultant (2015). My current position at International Union for Conservation of Nature and in support to the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services also inspires the following analysis.

In relation to Ganges governance processes, and for ways to improve them, I choose to further develop the lines of inquiries presented in 7.2 and directly

linked to the theoretical discussions of this doctoral work. I wish in particular to address the question '*How to address the plurality of river meanings in river governance processes?'* in the context of the Ganges. I therefore refer to the three subsequent lines of inquiries proposed in the section 7.2 of this concluding chapter, which target socially and environmentally more just river governance processes. I consider the second line of inquiry, which relates to the recognition of the geographical, historicized and bodily human-river relation largely addressed by the authorities or the communities themselves in the Indian context[110]. I thus mainly develop the first question related to '*which actor/group of actors 'speaks for the river' in decision-making processes*?', particularly to define '*how to speak for the river?*'.

Theoretically, this question is close to the reflections from Bruno Latour that he developed in his 'Draft for a Parliament of Things' (2018, first edition 1994). He made it clear that his proposition was not to create a new model, but to draw on what already exists[111]. The Parliament of Things that he suggests would reconcile and integrate the three functions of research, politics and administration, with an institutionally explicit existence. The new aspects of this Parliament would be: 1. a triple respect for the three functions would be ensured, 2. scientists would represent the non-humans in the negociation, 3. the processes would include agreed procedures for verification and standardisation, as well as evaluation, 4. the hybrid networks would be followed and mediated (Latour, 2018). How to speak for a river, then, if we follow this proposition? This model invites to create River Parliaments that would ensure the presence of scientists, policy-makers and administrative bodies. These people would collectively translate the networks of humans and non-humans, with all their complexities, thus enlarging the River Parliaments to relevant stakeholders. In the following lines, I attempt to concretely develop how these River Parliaments might function in the Indian context.

[110] See Chapters Two and Three.

[111] The Modern Constitution, with its main bias of artificially purifying networks of humans and non-humans, into science on one side, politics on the other side and administration in a third instance, has never neatly been inforced in real situations (Latour, 2018).

In the Ganges context, the Central government seems to be the main actor that 'speaks for the river' in decision-making process. Narendra Modi's discourse in July 2014 at Varanasi that was highlighted at the beginning of this manuscript, particularly illustrates this point. The declaration of Ganga as a National River (2008), the Eco-Sensitive Zone decision, endorsed by the Central Ministry of Environment (2012), or the draft Ganga Act in preparation by the Central Ministry for Water Resources (2018) tend to confirm. However, State governments are formally entitled to take decisions on water issues, according to the Constitution of India that defines water as a State subject. Should it then be State governments who should 'speak for the river'? As mentioned in Chapter Five, a former Uttarakhand State former Secretary vehemently criticized the Eco-Sensitive Zone decision as an 'intrusion' of a Central policy in 'their [State residents'] mountains'.

In order to suggest some change to that power-imbalanced situation, particularly towards States but also more importantly towards communities of residents and users, I propose to draw inspiration from a distant[112] context that I know well. In France, water is said to be the 'common heritage of the nation' ('*le patrimoine commun de la nation*') since the Water Law in 1992. This law also set up the possibility to constitute 'local water parliaments' at the watershed level. These parliaments comprised stakeholders' representatives, in proportion and according to some rules that are defined in the law. They are also entitled to design 'watershed management plans' in which they can design local regulation according to the issues and specificities of their river basin, duly documented by mandatory state-of-knowledge reports and assessments. In that context, these 'local water parliaments' are entitled to take decisions on rivers and to 'speak for the river'. The debates among conflicting perspectives take place during the assemblies of these 'parliaments'. Decision processes are predefined in a Regulation that is adopted by the parliament in the first months of its existence. Such an institution is simultaneously rooted in the local context, while following regulations and processes defined at an upper level of governance (for instance, the national level).

[112] It may seem contradictory to choose a distant, instead of close thus more easily replicable, context. However, as my aim is here only to draw a few lines for further inspiration, and not to develop a serious model of governance, I assume that a distant context may lead to identify more creative possibilities.

Some River Parliaments have been already set up in India by the Gandhian Rajendra Singh and its organisation *Tarun Bharat Sangh*. They started from initiatives with village residents in Rajasthan, in the 1980's. An interesting line of exploration would be to envisage their generalization over the Ganges basin, at district scales, with some inspiration from the ideas of Latour's 'Parliament of Things'. The following lines propose some concrete directions to operationalize this idea. Pragmatically, the choice of the district level would allow to make use of existing institutions and administrative frames of work as well as to access funds from the State level. However, importantly, the leadership should not be attributed to the district administrations but rather to local political figures from municipality or Gram Panchayat bodies, who should already be elected (to guarantee some representativeness). Their designation should be endorsed by formal votes among the River Parliament assembly. Funds should be made available for launching data collection, studies, restoration actions or specific events to encourage the engagement of local stakeholders. Actions should be based on programmatic three to five-year plans and disbursment of funds should be controlled by district administrations exerting the required due diligence, with detailed annual reports presented back to the River Parliament members. Funding decisions should remain the River Parliaments' prerogatives. Biodiversity, water and climate change mitigation issues should be tackled simultaneously. A large array of civil society organisations could be represented through a fixed number of representative seats in the River Parliament (all mandates should be fixed-term). Groups of volunteer scientists from local universities and research institutes should be involved in the processes too. One of their tasks would be to trigger scientific research developed from 'people's problems'. The River Parliament's activities should be formally reported to 1. District administrations 2.Gram Panchayat assemblies. At the State level, support and legal advice should be provided to these assemblies, and particularly to their leaders who should be invited to share their experience among peers. Dedicated full-time resources should be created for a secretariat, in order to ensure the coordination efforts required to sustain the River Parliament's operations. Finally, in reference to the third line of enquiry mentioned in section 7.2 (how to design a legitimate and sustained process to play the role of safeguarding the reversibility of decisions, initially, during and after implementation?), Parliament

members should collectively scrutinize the potential reversibility of any important decisions pertaining to the River. District administrations should ensure that any such decision should be systematically presented to the Parliament – or to one of its sub-group- for advice.

More generally, this research drew my attention on three outcomes that I did not consider when I worked as a water management professional in a European context: first, there is a need of a proper recognition of subtle incorporation of politics and political strategies into waters. This may happen with the choice of categories, within knowledge production processes, or through the subordination of some attention to waters to other political motives[113]. Second, the focus on the complexity of technical and scientific issues may distract attention from the social environment in which the ecological 'problems' occur. As encountered in my cases, 'river meanings' interfere among the various forces that operate in the 'strategic field of power relations' and some adequate analyses are required to design policy change that would be acceptable and equitable – not necessarily on a material aspect only, but also symbolically, in terms of recognition of aspirations and attachments. This is particularly at work in some conflicts in France today, in relation to programmes of river ecological restoration that remove water infrastructure heritages. Finally, this research also emphasized the need to design 'fluid governance' that would be able to adjust to moving and temporary realities (such as the ones encountered in the Bengali *chars*), in the context of climate change, conflicts and migrations. As partly reflected in this research, such a move would particularly require to question fixed categories and processes, as well as to move beyond conceptual binaries.

[113] The two striking quotes of Narendra Modi and Jawaharlal Nehru in the first page of this manuscript somehow illustrate this idea, however contrasted their expressions are: one quote aims to increase the legitimacy of the newly elected Prime Minister; the second quote aims to strengthen the image of a resilient and historically-rooted nation.

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APPENDICES

APPENDIX 1: PUBLISHED VERSION OF *VERS UNE 'GÉOGRAPHIE ENVIRONNEMENTALE' DES FLEUVES : RAPPROCHER POLITICAL ECOLOGY ET MÉSOLOGIE ?*

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VERS UNE « GÉOGRAPHIE ENVIRONNEMENTALE » DES FLEUVES : RAPPROCHER *POLITICAL ECOLOGY* ET MÉSOLOGIE ?

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RÉSUMÉ

Comment revisiter l'approche intégrée des cours d'eau dans le contexte de l'Anthropocène, pour une meilleure appréhension des enjeux environnementaux, politiques et sociaux autour d'un fleuve ? Cet article propose de bâtir un nouveau cadre théorique au sein des approches post-positivistes en géographie. Il démontre l'intérêt de rapprocher la political ecology *et la mésologie d'A. Berque, à la lumière d'un questionnement de l'« objet » fleuve et suite à l'analyse de travaux ciblés de la «* political ecology of water *».*

***Mots clés** : Fleuve, anthropocène, political ecology, mésologie, cycle hydrosocial.*

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INTRODUCTION

Alors que les débats se poursuivent sur la caractérisation d'une période géologique nouvelle, l'Anthropocène, marquée par l'empreinte humaine sur la terre, une large partie des géosciences se trouvent interpellées par l'accélération des transformations physiques, tant en amplitude qu'en rythme, observées depuis le milieu du XX^{e} siècle, qu'il s'agisse d'imperméabilisation des sols, d'extraction des ressources, de remodelage des vallées fluviales ou encore de changement climatique.

Convaincus que la géographie est concernée au premier chef et en réaction à « *l'écolosceptisme* » médiatisé de certains géographes français (qui affirment la capacité de la technique à répondre aux enjeux), les auteurs de l'ouvrage *Manifeste pour une géographie environnementale* (Chartier et Rodary, 2016) appellent à une prise en compte institutionnelle de « l'impact environnemental » sur la discipline. Proposant une démarche scientifique « *qui cherche efficacement à être au plus proche du monde dans lequel nous vivons* » (p. 15), tout en « *poursuivant des processus engagés dès la fondation de la discipline* » (p. 30), ces auteurs souhaitent voir réinterpréter les orientations épistémologiques, les buts et les pratiques de la géographie dans le contexte contemporain ; selon leurs termes, « *l'irruption de l'"environnement" a des conséquences qui nous paraissent définitives pour la discipline géographique* » (p. 15).

La géographie environnementale que propose cet ouvrage collectif revendique une position engagée, non surplombante dans l'approche des problèmes environnementaux ; en cela, elle rejoint explicitement la *political ecology.* Ce courant d'inspiration radicale et critique s'est notamment mobilisé pour dénoncer le jeu de dupes d'une écologie prétendue apolitique, qui n'interrogeait en réalité ni ses rapports au pouvoir ni la subjectivité de ses résultats (Robbins, 2012).

Questionnés par notre expérience de la gestion de l'eau et notamment celle des cours d'eau, nous souhaitons revisiter l'approche dite intégrée des fleuves et des rivières[1] grâce à l'emploi d'une perspective postpositiviste explicite. À cet effet, nous proposons de prendre au sérieux l'appel du manifeste de Denis Chartier et Estienne Rodary et de proposer dans cet article un nouveau cadre théorique pour une « géographie environnementale des fleuves ». S'écartant volontairement de l'approche par bassin versant, notre entreprise a pour but de repenser une « géographie des fleuves » afin de mieux saisir comment la matérialité ainsi que l'idée du fleuve opèrent dans la société et selon quels enjeux, notamment écologiques et politiques.

Pour bâtir ce cadre, nous nous attacherons, dans une première partie, à questionner « l'objet » fleuve[2]. À cet effet, nous balaierons l'histoire de l'étude des fleuves, qui permettra de retracer l'évolution des représentations « académiques » d'un fleuve. Nous justifierons alors l'intérêt de retenir un cadre non dualiste pour quitter la perspective réductrice moderne, suivant en cela les réflexions ontologiques développées en *cultural geography*, en particulier depuis la diffusion de l'*Actor-Network-Theory*. Dans une seconde partie, nous présenterons et analyserons les propositions de la *political ecology*, notamment les travaux spécifiquement menés autour des cours d'eau, ainsi que leurs limites. Nous montrerons en discussion que le couplage de la *political ecology* avec l'ontologie d'inspiration phénoménologique proposée

[1] Cette terminologie fait référence à l'IWRM (Integrated Water Resources Management) ou Gestion intégrée des ressources en eau, désormais une référence internationale pour la gestion de l'eau. Ses principes directeurs initiaux (*Dublin Statement*, janvier 1992) ont fait place à une approche plus technique et moins politique, s'appuyant sur la notion de « *planning cycles* » (Global Water Partnership website), introduits notamment au sein de la Directive-cadre européenne sur l'eau, CE, 2000.

[2] La distinction entre fleuve et rivière n'est pas traitée dans le présent article. Elle pourra faire l'objet d'investigations ultérieures.

par Augustin Berque, la mésologie (Berque, 2014), établit un cadre théorique prometteur pour une nouvelle « géographie des fleuves ».

L'évolution de l'étude des fleuves et réflexions sur l'« objet » fleuve

Pour mieux appréhender l'« objet » fleuve, nous souhaitons parcourir l'évolution des représentations attachées aux fleuves, en suivant particulièrement les regards « savants » ou scientifiques. Pour ce faire, nous dressons une brève histoire de l'étude des fleuves. Nous faisons le choix d'une approche schématique qui met en avant le lien entre sciences et objectifs assignés, entre outil de connaissance et stratégie de connaissance.

Un tel détour historique rend compte de l'épaisseur de la catégorie mais aussi des effets de construction sociale qui prédéterminent un regard sur le fleuve. Nous empruntons ce raisonnement à Jamie Linton qui dans son ouvrage *What is water ?* (Linton, 2010) présente « l'histoire d'une abstraction moderne », afin de révéler les visions hégémoniques de l'eau. Comme lui, nous proposons de retenir trois phases schématiques : la phase prémoderne, la phase moderne et la phase postmoderne[3].

La phase prémoderne : la connaissance accompagne la dépendance au fleuve

Cette phase englobe l'Antiquité ainsi que toute la période médiévale et s'achève, selon l'usage, à la Renaissance. Afin de ne pas se limiter aux références gréco-latines, nous faisons usage de l'œuvre *La civilisation et les grands fleuves historiques*, de Léon Metchnikoff, secrétaire scientifique et proche d'Élisée Reclus[4]. Cet ouvrage[5], publié en 1889 par Élisée Reclus et préfacé par lui, présente une analyse des relations fleuve-société au sein des civilisations égyptiennes, mésopotamiennes, indiennes et chinoises, développées dans l'Antiquité autour des grands fleuves tels le Nil, le Tigre et l'Euphrate, l'Indus et le Gange ainsi que le Yangtze.

Dans cet ouvrage, de nombreux exemples tirés d'écrits anciens ou de découvertes archéologiques mettent en évidence l'importance, à la période antique, du fleuve en tant que pourvoyeur d'eau et de sédiments fertiles pour l'agriculture, source

[3] L'expression « postmoderne » est à prendre au sens large, et regroupe l'ensemble des approches critiques, parfois contradictoires, qui se sont imposées dans les années 1980 et qui ont en commun de s'opposer à l'approche positiviste. Cette proposition rejoint celle de Mark Moberg au sujet de l'anthropologie (Moberg, 2013) ou celle de Steven Flusty pour la *cultural geography* (Flusty, 2005).

[4] Léon Metchnikoff faisait partie du cercle des géographes anarchistes russes autour d'Élisée Reclus, avec Kropotkine et certains autres (Pelletier, 2013) ; il était également professeur à l'Académie de Neuchâtel. Son discours d'ouverture des travaux de la Société neuchâteloise de géographie, publié dans le *Bulletin de la SNG* en 1885 a fait l'objet de commentaires publiés récemment par Patrick Rérat et Étienne Piguet (Rérat et Piguet, 2011).

[5] Dans cet ouvrage, Léon Metchnikoff défend la thèse que ces civilisations isolées se sont développées grâce aux fleuves, véritables « éducateurs des peuples », par le développement d'une solidarité et l'organisation de travaux collectifs qu'imposent les contraintes fortes de ces milieux.

de nourriture des hommes et du bétail. Sans doute à ce titre les fleuves sont-ils divinisés, comme en Égypte ancienne ou en Inde, ainsi qu'en témoigne l'hymne au Nil retrouvé sur le papyrus dit Sellier, traduit par Gérard Maspéro : « *Se lève-t-il* [le Nil], *la terre est remplie d'allégresse, tout ventre se réjouit, tout être a reçu sa nourriture, toute dent broie* » (Metchnikoff, 1889, p. 211).

Durant cette période, la connaissance des fleuves est rarement développée pour elle-même, y compris dans les géographies grecques en dépit du paradigme idéaliste. À titre d'exemple, l'hydrographie développée par le grec Strabon dans sa *Géographie* a pour but de délimiter les territoires et les peuples et de présenter les lignes de force de l'espace anatolien, selon l'analyse de Carole Rottier (Rottier, 2010).

L'approche est en outre principalement descriptive ; les tentatives d'explication, comme celles de l'auteur latin Sénèque dans ses *Questions naturelles*, face notamment à l'effroi généré par les crues violentes, se heurtent à des mystères indéchiffrables concernant l'origine des fleuves. Cependant, l'unité « fleuve » entre sa source et son delta est déjà conceptualisée, comme en témoigne la *Géographie* de Ptolémée, datée du IIe siècle de notre ère (voir figure 1).

Aussi la stratégie de connaissance vise-t-elle principalement à accompagner la dépendance au fleuve, dans un rapport d'*accommodation*, comme le suggère Élisée Reclus (préface à Metchnikoff, 1889). De façon individuelle ou collective, il s'agit de tirer le meilleur bénéfice du fleuve et de tenter de minimiser ses destructions (les offrandes au fleuve divinisé pourraient en être une modalité), sans remettre en question le lien de dépendance de la société au fleuve. En outre, la connaissance disponible semble annexée à la *trilogie* principale *eau-croyance-pouvoir* relevée par le géographe Pierre Gentelle dans ses travaux sur les vestiges archéologiques d'infrastructures de l'eau (Gentelle, 2003). La tradition scolastique du Moyen Âge ne semble pas avoir bouleversé ces rapports ; selon Jamie Linton, elle s'est plutôt désintéressée de ces questions (Linton, 2010).

La phase moderne : une mise à distance entre hommes et fleuves

La rupture principale dans l'évolution de la « science des fleuves » apparaît après la Renaissance, avec l'essor en Occident des mathématiques et de la physique à qui les esprits modernes ordonnent d'expliquer le monde, indépendamment des religions et de leur caractère transcendant. On pourrait schématiser cette période selon une nouvelle trilogie *eau-science-pouvoir*, en remplaçant le terme « croyance » par celui de « science » dans la trilogie précitée. Sur le plan philosophique, le dualisme nature-société est acté et contribue également à une mise à distance conceptuelle entre hommes et fleuves.

En outre, selon le paradigme moderne, grâce aux nouveaux outils scientifiques, les fleuves doivent désormais se soumettre aux activités humaines. Les besoins militaires, ainsi que le développement de technologies testées lors des Grandes Explorations enclenchent le développement d'une hydrographie élaborée. La clarification au XVIIe siècle des grandes étapes du cycle hydrologique (évaporation, condensation, précipitation, infiltration, ruissellement) élucide définitivement la question de l'origine des fleuves (Linton, 2010). Par la suite, l'étude des fleuves

Figure 1 : Carte établie au XV^e^ siècle d'après la Géographie *de Ptolémée (*Wikipédia, *2016).*

suit une voie identique à celle de la géographie physique, mue par des impératifs utilitaires et stratégiques, comme ceux liés au projet colonial. On assiste en outre à une spécialisation croissante des sciences et à l'apparition progressive de disciplines telles l'hydraulique, l'hydrologie, la sédimentologie, l'hydrogéologie, aux côtés de celles qui scrutent la qualité des eaux et leur écologie.

La volonté de rendre compte mathématiquement de la réalité afin de la maîtriser, ainsi que la complexité rencontrée par les ingénieurs dans la sphère appliquée (dimensionnement d'ouvrages d'ampleur nationale comme les grands barrages) conduisent à fractionner les problèmes pour réduire les facteurs considérés et minimiser l'erreur des modélisations mathématiques (Pardé, 1959). Les dimensions sociales des problèmes traités par les « scientifiques des fleuves » sont écartées, notamment la question des impacts anthropiques sur le fleuve. L'humain ne figure pas dans l'objet d'étude.

Néanmoins, l'un de ces scientifiques, Maurice Pardé, professeur à l'École supérieure d'hydrologie de Grenoble, semble en prendre conscience et formule à la fin des années 1940 une « science des fleuves » ou « potamologie » qui veut recréer une unité de connaissance globale autour des fleuves. Elle se compose essentiellement de deux branches de « sciences dures », l'hydrologie fluviale et la dynamique fluviale, et se réfère abondamment à l'algèbre et aux calculs de probabilité, mais elle intègre dans les facteurs de l'hydrologie fluviale, l'étude des « *travaux humains* ». Dans l'introduction de son ouvrage non achevé *L'abondance moyenne annuelle des rivières*, Maurice Pardé indique en effet que :

> « L*es explications relatives à la Potamologie doivent invoquer largement et donc bien connaître tous les facteurs géographiques naturels* […] *et de plus en plus maintenant, les causes artificielles, c'est-à-dire introduites par l'homme* » (Pardé, 1994 dans *Les Cahiers de la Revue de géographie alpine*, 12, 42).

La phase postmoderne[6] : la relation fleuve-société réinterrogée

À partir des années 1960, les sciences environnementales, dont l'essor est suscité par l'écologie militante, visent à corriger la cécité des approches scientifiques précédentes vis-à-vis des impacts anthropiques sur l'environnement. De nouveaux champs d'études, comme l'écotoxicologie ou l'indication biologique[7] pour les cours d'eau, sont explorés par la communauté scientifique dans le but d'affiner les diagnostics. Ces recherches sont en général soutenues par les sphères techniques et publiques en charge de la gestion des ressources en eau car l'utilisation de ces connaissances actualisées contribue à les légitimer.

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[6] Voir note précédente en bas de page pour la justification de ce terme (note 3).

[7] Cette science a pour objet la mise au point et le suivi d'indicateurs environnementaux qui reposent sur l'analyse des compositions, des fonctions, ou de l'état d'espèces vivantes sélectionnées. Ces indicateurs biologiques présentent l'intérêt de refléter les effets combinés des différentes pressions anthropiques qui s'exercent sur les milieux, à la différence de simples indicateurs physico-chimiques.

Cependant, en parallèle de ce mouvement pour « plus de sciences », une critique de la rationalité et de l'approche scientifique moderne se développe significativement dans les années 1980 au sein de divers courants postmodernistes. La remise en question de l'hégémonie de l'interprétation « scientifique » du monde est à l'origine d'une rupture de paradigme en ce qui concerne la « science des fleuves », même si cohabitent aujourd'hui approches scientifiques et approches critiques.

Suivant Bruno Latour, les scientifiques font l'objet d'études ethnographiques ; la production du savoir scientifique se trouve déconstruite. Plus radicalement, la prétendue objectivité de la science moderne et son caractère apolitique sont dénoncés. Les dimensions du langage, du pouvoir, des normes et des pratiques sociales se raccrochent aux objets scientifiques qui ne peuvent plus être étudiés dans les mêmes termes. Ce sont désormais les relations entre humains et non humains, les agencements, les hybrides qui sont considérés (Latour, 1991). Bruce Braun reprend le terme de « *non-modern ontologies* » pour qualifier l'ensemble des travaux anglo-saxons, notamment en géographie, qui adoptent ce cadre car il ne s'agit plus d'une rupture épistémologique, mais ontologique (Braun, 2008). En effet, ces théories supposent un monde où les frontières de « ce qui est », notamment entre humains et non-humains, ne sont non plus fixes comme dans la « Constitution moderne », mais en perpétuelle recombinaison, suivant le concept de « réseaux » de la théorie de l'acteur-réseau (Latour, 1991).

Cette nouvelle « ère ontologique » réinterroge la relation nature-culture ou société-environnement. La principale critique portée aux approches dualistes nature-culture est leur myopie relative à la réalité du rapport entre hommes et choses. En conséquence, les propriétés que fixent, aux uns et aux autres, les travaux académiques dualistes sont des illusions qui affectent leurs résultats. Karen Bakker et Gavin Bridge montrent à l'inverse comment la nouvelle approche enrichit la géographie des ressources ; les actions propres des ressources, par exemple celles d'amplification ou de résistance aux projets humains, sont désormais intégrées (Bakker et Bridge, 2006).

Ces *non-modern ontologies* imprègnent également les travaux récents d'*emotional ecology* (Smith, 2013), ceux de *political ecology of emotion* (Sultana, 2015) ou encore le courant de *political ecology of water* (voir partie suivante). Celui-ci explore les multiples facettes du « cycle hydrosocial » qui met en évidence la relation dialectique qualifiée d'*interne* entre eau et société (Linton et Budds, 2014).

Dans une même veine ontologique, mais selon une conceptualisation différente qui s'appuie sur une vision phénoménologique[8], le géophilosophe français Augustin Berque a élaboré ce qu'il nomme la mésologie[9] ou l'étude des milieux.

[8] Cette approche conçoit le monde ainsi : « *objets et sujets s'interpénètrent pour former un monde géographique qui n'est accessible que par l'expérience vécue* » (Pradeau, 2013, article « Phénoménologie »), ou encore, selon les mots d'Éric Dardel : « *entre l'Homme et la Terre, se noue et demeure une sorte de complicité dans l'être* » (Dardel, 1952, p. 8).

[9] Ce terme ne doit pas être pris au sens de la mésologie développée par un disciple d'Auguste Comte, Charles Robin, au XIX^e^ siècle, à l'épistémologie positiviste et déterministe (Berque, 2014).

Comme nous le verrons dans la suite de cet article, cette proposition paraît particulièrement adaptée pour saisir l'épaisseur du rapport société-fleuve.

Que conclure au sujet de l'« objet » fleuve ?

L'analyse des différents regards portés sur les fleuves en tant qu'objets de connaissance au cours de l'histoire permet d'éclairer la richesse de « l'objet » fleuve, voire s'il reste un objet. Ces réflexions nous conduisent à proposer une typologie non exhaustive de représentations du fleuve que nous listons ci-après. L'ordre dans lequel nous les présentons est signifiant : il suit le développement historique des sciences et vise à montrer l'enrichissement progressif de la notion de fleuve qui en résulte.

Ces représentations, fruits d'interprétations scientifiques diverses du fleuve, se sont parfois succédé dans le temps ou à l'inverse peuvent coexister dans des périodes similaires malgré leurs contradictions, à l'image des représentations sociales nécessairement plurielles (aujourd'hui coexistent par exemple en Inde la représentation du fleuve Gange en tant que divinité et celle d'un espace de loisir où se pratique le rafting).

Ces représentations se rapportent donc chacune à un regard « académique » sur le fleuve en tant que :

1. axe, que l'on reporte sur une carte (hydrographie dès la période antique) ;
2. élément de la croûte terrestre, avec son lit mineur relativement bien perceptible dans le paysage malgré ses variations saisonnières ou interannuelles, son lit majeur (sa vallée), ou encore, plus récemment, son bassin versant (géographie physique) ;
3. quantité d'eau qui coule (il s'agit du sens littéral du grec « *potamos* », traduit en français par fleuve). Dans cette représentation, la quantité de sédiments transportés par le fleuve est souvent négligée, non sans conséquence (envasement incontrôlé des barrages, modification des flux sédimentaires qui aggrave l'érosion côtière) (hydrologie) ;
4. écosystème (siège de processus biogéochimiques et vivants), potentiellement transformé par les activités humaines (écologie) ;
5. milieu. Celui-ci est explicatif des traits de la société humaine qui y évolue (mésologie positiviste) ;
6. construction historique et sociale, simultanément matérielle et pensée, modelée par certaines activités humaines et modelant en retour les pratiques, les structures et les liens politiques (concept du cycle hydrosocial en *political ecology of water*) ;
7. actant. Doué d'une capacité d'action évidente (destruction de digues, fertilisation des sols) bien que dénué d'intention, il s'intègre continuellement à des réseaux (ontologie non moderne de l'acteur-réseau) ;
8. réalité trajective, c'est-à-dire ni objective ni subjective, simultanément physique, écologique et interprétation humaine, à l'image de l'« *écoumène* » (mésologie d'Augustin Berque (Berque, 2014, 2016).

Nous terminons sur cette représentation car elle porte en effet les réflexions sur le « milieu », ici le fleuve, plus loin que celle de « l'actant ». Ces résultats seront repris et détaillés dans la discussion.

Vers une géographie environnementale des fleuves : que nous enseigne la *political ecology* ?

La première partie nous a permis d'enrichir la notion de « fleuve » dans la perspective de bâtir une « géographie environnementale des fleuves ». Dans cette deuxième partie, nous tentons de dessiner les contours d'une telle approche grâce à l'analyse de la littérature de *political ecology* consacrée aux fleuves.

Pourquoi la *political ecology* ?

Denis Chartier et Estienne Rodary ont formulé dans leur ouvrage sept positionnements théoriques qu'ils qualifient d'essentiels à la construction d'une géographie environnementale. Celle-ci doit présenter les caractères suivants : une *géographie cosmopolitique* (poser explicitement la question politique), une *géographie postdéterministe* (reconnaître le rôle réel des contraintes ou des opportunités « naturelles »), une *géographie d'un Monde rugueux* (appréhender et intégrer sur le plan conceptuel tant les particularités – « rugosités » – que les phénomènes globaux), une *géographie située* (approfondir la réflexivité du chercheur, situer le contexte de la production scientifique), une *géographie de la justice* (révéler les injustices sociales et environnementales), une *géographie sensible* (accorder une ouverture aux perceptions, aux récits et aux savoirs non rationnels), une *géographie du lâcher-prise* (se déprendre de la volonté de maîtrise de l'espace et des territoires) (Chartier et Rodary, 2016, p. 31-43).

Ces principes, directement inspirés de la *political ecology* (à laquelle ces auteurs se rattachent explicitement) pour les cinq premiers d'entre eux, en élargissent la philosophie d'investigation selon la dimension sensible et celle du lâcher-prise. Comme en *political ecology*, l'accent est mis par ces auteurs sur la nécessité d'« *extensions appliquées* » dans l'approche académique pour répondre à « *une volonté d'action* » (Chartier et Rodary, 2016, p. 15). Nous avons donc choisi d'investiguer, au sein de la *political ecology*, les travaux qui se concentrent sur la thématique eau.

Présentation du courant de *political ecology of water*

Deux auteurs, Alex Loftus et David Blanchon, ont réalisé chacun une synthèse du courant de *political ecology of water* (Loftus, 2009 ; Blanchon, 2016). Alex Loftus étudie davantage les contenus, tandis que Blanchon établit la filiation et les emprunts théoriques de la discipline.

L'expression « *political ecology of water* » est empruntée à Alex Loftus, tandis que David Blanchon préfère évoquer ce courant sous l'appellation « *radical political ecology* ». Tous deux s'accordent sur le fait que les questions de justice d'accès à la ressource en eau sont l'objet principal de ces recherches. Selon Alex Loftus, le caractère commun le plus affirmé du courant est « *le désir de politiser les environnements de manière à pouvoir les transformer* » (Loftus, 2009, p. 954, traduction libre), conformément à l'approche « *hatchet and seed* » – critiquer mais aussi contribuer aux solutions – proposée par Paul Robbins pour la *political ecology* (Robbins, 2012).

Initié par le géographe Erik Swyngedouw à la fin des années 1990, ce courant s'est développé au Royaume-Uni puis aux USA, grâce à Maria Kaika, Karen Bakker et Jamie Linton. Les théories sous-jacentes sont principalement l'écomarxisme, à la suite de David Harvey et de Noel Castree, et la sociologie de l'acteur-réseau, malgré les difficultés d'ordre épistémologique d'un tel rapprochement (Blanchon, 2016).

Ainsi que l'indique David Blanchon, ce courant assure une relecture des thèmes traditionnels de l'eau, en adoptant une critique « radicale » (critique du mode de production capitaliste), ainsi qu'une critique des approches « naturelles » de l'eau, qui méconnaissent sa dimension de construction sociale. Les études de cas mettent en évidence le caractère construit des situations de sécheresse, et les jeux de pouvoir autour de l'approvisionnement en eau potable des villes, notamment ceux liés à la privatisation des services de l'eau. Ce deuxième thème est d'ailleurs le seul que retient Alex Loftus dans son entreprise de « *repenser les* political ecologies *de l'eau* » (Loftus, 2009).

Cependant, la question du statut de l'eau est également un chantier théorique important de ce courant (Blanchon, 2016). De nouveaux outils conceptuels sont proposés comme le *cycle hydrosocial (*Bakker, 2000 ; Swyngedouw, 2002 ; Linton et Budds, 2014). Ce concept se démarque du cycle hydrologique pour rendre compte de la relation dialectique (qualifiée progressivement par les auteurs d'interne) entre eau et société ; il invite à réinterpréter les discours et les représentations de l'eau, pour en révéler notamment les ressorts politiques ou les effets d'injustice sociale (Linton et Budds, 2014).

Ces travaux ont essaimé au-delà de la sphère anglophone. Des auteurs francophones tels François Molle, Gabrielle Bouleau, Sara Fernandez, Olivier Graefe, David Blanchon ont développé depuis les années 2000 des travaux dans le domaine de l'eau se référant explicitement à la *political ecology,* mais présentant un caractère « *clairement moins radical* » que l'approche anglophone (Blanchon, 2016, p. 272). Ces travaux questionnent principalement les non-dits (par exemple, le choix des échelles) ou les angles morts des politiques publiques menées dans le domaine de l'eau.

Les travaux de ce courant peuvent être ainsi rapportés à trois catégories d'intentions, qui parfois se cumulent : une approche « philosophique », attachée à clarifier les représentations et le statut de l'eau, une approche « politique » qui vise à dénoncer le capitalisme, les injustices sociales ou les mesures antidémocratiques, avec une dimension parfois militante et enfin une approche « appliquée ». Celle-ci met en évidence les contradictions ou les biais inhérents aux pratiques de gouvernance et de gestion de l'eau, notamment celles menées à l'échelle des bassins des grands fleuves que nous étudierons plus particulièrement dans la sous-partie suivante.

Les travaux de *political ecology* relatifs aux fleuves : des approches orientées gouvernance, savoir et échelles

Nous avons vu précédemment que la recherche en *political ecology of water* a surtout étudié les services d'adduction d'eau en milieu urbain. En effet, les processus de « marchandisation » de l'eau urbaine, notamment en Grande-Bretagne, avaient

fait fortement réagir la composante néomarxiste de la *political ecology*. Seule une minorité des travaux en *political ecology of water* (une quinzaine à notre connaissance)[10] ont ainsi pris pour objet d'étude un fleuve ou son bassin versant.

Nous allons ici présenter succinctement ces travaux à travers leurs principales caractéristiques, avant de dégager en discussion une esquisse de « géographie environnementale ». Une première observation s'impose : seuls quelques grands fleuves ont été étudiés selon cette approche, notamment le Mékong qui a fait l'objet du plus grand nombre de travaux (au moins 6), par exemple ceux de Bakker (1999), Sneddon et Fox (2006) et Matthews (2012).

Les travaux recensés se rapportent tous, au moins en partie, à l'approche « appliquée » telle qu'établie dans la sous-partie précédente. Les questions ontologiques (Bakker, 1999 ; Bouleau, 2014) ou politiques (Alatout, 2012 ; Bourblanc et Blanchon, 2014 ; Graefe, 2011 ; Norman et Bakker, 2009 ; Sneddon et Fox, 2006 ; Tvedt, 2011) se rattachent à des réflexions relatives à la gouvernance et aux modes de gestion des eaux.

À travers le choix des fleuves, la plupart des travaux questionnent les échelles ou encore les mesures de « *rescaling* » (notamment Bourblanc et Blanchon, 2014 ; Norman et Bakker, 2009 ; Sneddon et Fox, 2006 ; Vogel, 2012). L'usage hégémonique du concept de bassin versant, par ailleurs promu par les organisations internationales, la Commission européenne et de nombreux États, y est souvent critiqué, rejoignant les travaux d'Olivier Graefe ou de François Molle sur ce thème (Graefe, 2011 ; Molle, 2009). Ces travaux se rattachent ainsi aux recherches en « *politics of scale* » (Rangan et Kull, 2009 ; Swyngedouw et Heynen, 2003) et visent à révéler la construction sociale des échelles, abusivement présentées comme données.

Ces travaux se concentrent, avec succès, sur une thématique classique de *political ecology* : la répartition sociale des bénéfices et des coûts, au sein des périmètres emboîtés de la gestion des fleuves (notamment Molle, 2005 ; Matthews, 2012 ; Vogel, 2012). Les enjeux propres au contexte dictent les axes d'études retenus, par exemple ceux de l'hydroélectricité (Mékong), de la modernisation agricole (Chao Phraya : Molle, 2005), des politiques ségrégationnistes (fleuves d'Afrique du Sud : Bourblanc et Blanchon, 2014), colonialistes (Nil : Tvedt, 2011) ou nationalistes (Jourdain : Alatout, 2012). Les narrations propres à chacun des fleuves assignent donc à l'analyse la sélection des aspects géopolitiques, économiques, législatifs ou encore l'attention relative portée aux divers acteurs. Institutions, groupes politiques, producteurs, scientifiques, mouvements militants, etc. sont plus ou moins scrutés, compte tenu de leurs rôles respectifs dans la production du savoir, les représentations politiques, les décisions publiques ou enfin l'attribution concrète des accès à l'eau.

Néanmoins, les dimensions proprement matérielles et écologiques du fleuve sont peu exploitées. Nous rejoignons en cela la critique formulée par les travaux qui réinvestissent la dimension matérielle (« *bodily* » ou encore *feminist geographies* notamment). Pourtant, deux travaux se distinguent à ce titre : celui de Garry Peterson,

[10] La référence à la *political ecology* n'est pas toujours explicitée, mais ces textes se réfèrent aux concepts clés de la discipline comme l'« *hydrosocial cycle* » ou encore aux auteurs tels Erik Swyngedouw, Karen Bakker ou Jamie Linton.

mené sur la rivière Columbia (États-Unis), qui suggère de modéliser le fonctionnement d'un fleuve dans son contexte sociopolitique à l'image d'un écosystème dans son environnement (Peterson, 2000). L'étude de cas présentée ne retient cependant que l'espèce saumon comme représentative de l'écologie du fleuve, sans que ce choix ne soit justifié. Elle perpétue également une juxtaposition des aspects écologiques d'un côté et sociopolitiques de l'autre (ontologie dualiste), relevant d'une approche de *social-ecological systems* (Berkes *et al.*, 2003). La seconde étude qui fait exception est la recherche menée par Gabrielle Bouleau sur le Rhône et la Seine, dans laquelle les indicateurs biologiques retenus pour chacun des fleuves sont détaillés et leurs choix, questionnés, révélant une coproduction entre science et fleuve (Bouleau, 2014).

En outre, les registres sensibles et émotionnels sont absents de ces travaux. Un constat similaire a conduit des géographes à réinvestir la dimension émotionnelle qui traverse le monde, soit au sein de leur objet d'études comme Farhana Sultana lorsqu'elle explore le « travail émotionnel » de femmes au Bangladesh qui doivent négocier chaque jour l'accès à une eau saine (Sultana, 2015), soit au sein même de la pratique ou de l'éthique du chercheur (Chartier et Rodary, 2016 ; Smith, 2013).

Enfin, si les représentations ou les imaginaires de l'eau sont parfois évoqués dans les narrations autour des fleuves (Alatout, 2012 ; Bakker, 1999 ; Bouleau, 2014 ; Molle, 2005 ; Sneddon et Fox, 2006), ces aspects n'y sont en général pas développés. Les dimensions symboliques, éthiques et religieuses qui pourraient s'y rapporter ne font pas l'objet d'analyses spécifiques ; or, ces liens, ces attachements sont susceptibles de jouer un rôle significatif dans le « *champ stratégique des relations de pouvoir* » (Foucault, 2001), au travers d'actions individuelles ou collectives[11].

Discussion : les contours d'une géographie environnementale des fleuves

Grâce à l'analyse menée précédemment, nous confirmons la pertinence de la *political ecology* pour une « géographie environnementale des fleuves », à travers l'explicitation des savoirs mobilisés et des discours dominants, l'analyse des « *politics of scale* » ainsi que la dénonciation des injustices sociales, environnementales ou des mesures antidémocratiques, dans la gestion des fleuves.

Cependant, à la lumière des rapports société-fleuve dégagés au long de la première partie de l'article, ces recherches ont tendance à négliger deux questions *a priori* significatives, notamment au regard d'autres ressources en eau (nappe souterraine, réservoir, canal, réseau d'irrigation) fondamentalement plus homogènes et moins « civilisationnelles », selon la proposition de Léon Metchnikoff :

[11] Une littérature récente semble y prêter désormais attention. Nous pouvons signaler l'article de Suzanne Dallman qui relate les liens spirituels et émotionnels entre la tribu Winnemem Wintu et ses espaces sacrés résiduels, menacés par l'extension du barrage Shasta en Californie (Dallman *et al.*, 2013). Ces liens, perçus comme inséparables de l'identité et de la mémoire de la tribu, sont à l'origine de sa lutte – d'ordre plutôt symbolique – contre ce projet. Une anthropologue américaine a également publié en mai 2017 un livre explorant la *political ecology* des barrages sur le Gange amont avec une attention centrale au rôle de la foi hindoue dans les mouvements locaux (Drew, 2017).

– dans quelle mesure l'hétérogénéité physique et écologique du cours d'un fleuve intervient dans la co-construction société-fleuve ;
– comment les registres émotionnels, symboliques et idéologiques autour d'un fleuve agissent dans le cycle hydrosocial.

Pour bâtir une véritable « géographie environnementale des fleuves », nous pensons ainsi qu'il convient, dans le cycle hydrosocial, de porter simultanément l'attention aux éléments matériels d'un fleuve ainsi qu'aux émotions, symboles et interprétations qui lui sont intrinsèquement attachés, en tant que milieu humain. Dans ce qui suit, nous examinerons plus particulièrement ce deuxième aspect.

Symboles, émotions et interprétations émergent des rapports sensibles entre individus et fleuve mais aussi des représentations collectives, des systèmes de préférences et de valeurs, voire des religions et des idéologies. L'importance des idéologies a d'ailleurs été soulignée par Erik Swyngedouw dans son analyse du « rêve hydrosocial » de Franco pour l'Espagne (Swyngedouw, 2007) ou autour des « imaginaires géopolitiques » du Jourdain, par Samer Alatout (Alatout, 2012). La question religieuse est également prégnante dans certains contextes. Elle est par exemple indissociable du Gange en Inde ; elle apparaît comme un levier politique pour l'actuel gouvernement nationaliste hindou à travers le programme de restauration du fleuve, « Namami Gange Programme » (voir figure 2) et comme un déclencheur pour la mobilisation de certains opposants (mouvement Ganga Ahvaan).

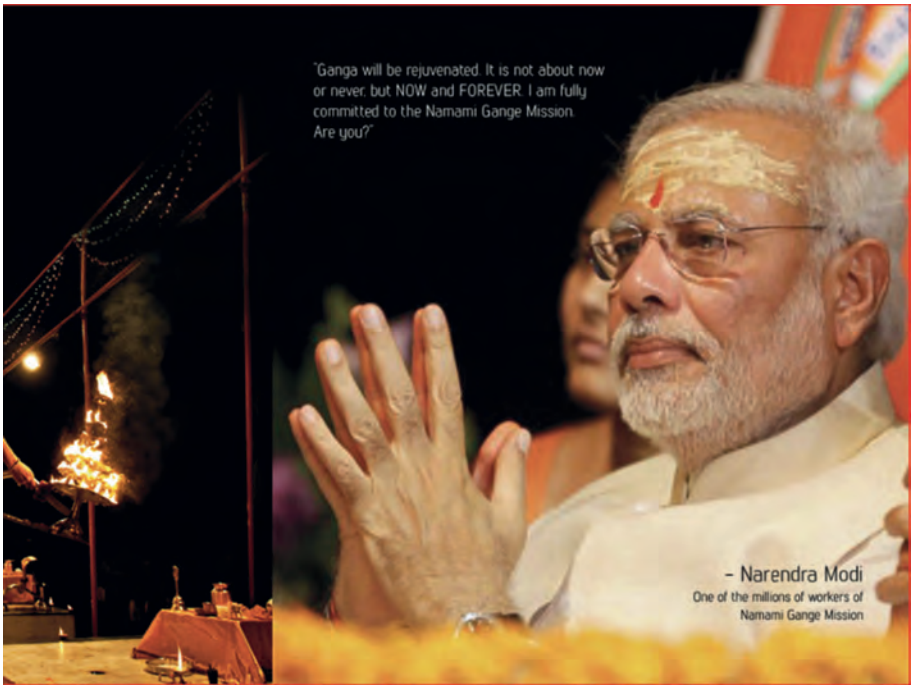

Figure 2 : Promotion du programme national « Namami Gange Programme » (National Mission clean Ganga website, 2016).

Cependant, pour aller au-delà d'une lecture en surface des phénomènes d'attachement et de mobilisation identitaires liés au fleuve, ou encore pour approfondir les liens complexes entre dimensions matérielles (perceptions, pratiques) et dimensions conceptuelles (représentations, valeurs, éthiques et idéologies) dans les rapports fleuve/société, nous proposons d'enrichir la *political ecology* avec la mésologie d'Augustin Berque. Il convient de noter que les études de cas en mésologie sont rares, le cadre théorique n'ayant été consolidé que récemment (Berque, 2014). La réflexion d'A. Berque est cependant née de son terrain principal, le Japon (Berque, 1986) et de son étude approfondie des paysages ruraux de Hokkaidô, dans laquelle il fait intervenir des analyses linguistiques avancées.

La mésologie appartient explicitement aux ontologies non-dualistes : « *la mésologie n'est rien de moins qu'une remise en cause des fondements du paradigme occidental moderne classique* qui a séparé objet et sujet]» (Berque, 2014, p. 67). Nous défendons néanmoins la compatibilité des épistémologies de la mésologie et de la *political ecology* (comme entre *Actor-Network-Theory* et *political ecology*) dans la mesure où cette dernière est davantage une communauté de pratiques qu'une discipline à l'épistémologie fixée (Robbins, 2012 ; Braun, 2008).

C'est à travers ses concepts de « milieu », de trajection et de « processus éco-techno-symboliques » que la mésologie nous paraît remarquablement compléter la *political ecology*. Le milieu, selon A. Berque, est engendré par la relation entre fleuve et homme/société. Cependant, ces deux pôles ne sont plus les pôles abstraits modernes objet/sujet mais deux réalités « trajectées » l'une dans l'autre. La réalité du milieu n'est ni objective ni subjective, mais simultanément physique, écologique et interprétation humaine, à l'image de l'« *écoumène* » (Berque, 2014, 2016).

La « trajection » désigne la relation, nécessairement historique, de transformation réciproque et incessante, en va-et-vient, entre milieu et société humaine (Berque, 2014). Le mécanisme principal de la trajection est l'interprétation humaine du « *donné environnemental* » (*Umgebung*), « *par les sens, par l'action, par la pensée* » (Berque, 2014, p. 60) qui devient milieu (ou plus largement, monde au sens de Umwelt), puis qui est à nouveau réinterprété de façon itérative. Les milieux humains deviennent en quelque sorte « de plus en plus humains » au fil des interprétations successives, et l'ensemble de ces processus itératifs forme des « *chaînes trajectives* » (Berque, 2014, p. 73).

Enfin, la proposition de « processus éco-techno-symboliques » nous intéresse car elle fait la synthèse des dimensions simultanément matérielles et conceptuelles de la relation entre l'homme et son milieu. D'une part, elle reconnaît l'interdépendance de ces dimensions, comme le détaille A. Berque à propos du « corps qui pense » et de l'importance de la « carnalité du monde » dans la pensée (Berque, 2016, p. 312-313). Elle introduit d'autre part un accent sur la dimension symbolique, au-delà des dimensions rationnelles du cognitif. A. Berque insiste sur ce point quand il évoque deux processus à l'œuvre dans l'interprétation humaine : les chaînes causales et les métaphores (Berque, 1986). Ces dernières ont par exemple le pouvoir de flouter la temporalité, réactivant le passé ou anticipant sur des possibilités, avec des conséquences sur le présent, donc de s'extraire tout à fait des chaînes causales ou chaînes logiques. A. Berque écrit ainsi : « *la réalité du milieu est à la fois présente, passée et possible* » (Berque, 1986, p. 151).

L'intérêt de la mésologie pour une géographie environnementale des fleuves réside dans l'importance accordée simultanément aux sens (perceptions), aux actions (pratiques) et à la pensée (chaînes causales et métaphores), avec une attention aux

expressions émiques (le langage local par exemple), mais aussi aux valeurs, aux symboles et aux idéologies. Cette insistance sur la gamme complète de l'interprétation humaine nous semble absente de la notion de cycle hydrosocial, telle que théorisée par Jamie Linton et Jessica Budds (Linton et Budds, 2014). Pourtant, cette attention est capitale pour saisir la pleine texture du rapport société-fleuve, dont nous avons démontré la richesse au long de ce texte.

En outre, la mésologie invite la géographie à « *embrayer sur l'ontologie* » (Berque, 2014, p. 47) comme le pratiquent les *politics of ontology* en anthropologie. Ces approches récentes entendent notamment investiguer les multiples potentialités des formes d'existence instituées par les pratiques, ou encore « *how things could be* », dans la perspective d'une « *permanente décolonisation de la pensée* » (Holbraad, Pederson et Viveiros de Castro, 2014).

Enfin, parce que l'homme est « trajecté » dans son milieu et réciproquement, A. Berque propose une « *éthique de l'écoumène* » qui n'absolutise ni le milieu, ni l'homme mais les considère simultanément (Berque, 2014). Cette proposition nous semble particulièrement intéressante à développer dans le contexte actuel du double mouvement de « spiritualisation de l'écologie » et « d'écologisation des spiritualités/religions » que l'on peut observer[12], qui soulève de nouvelles questions éthiques et politiques.

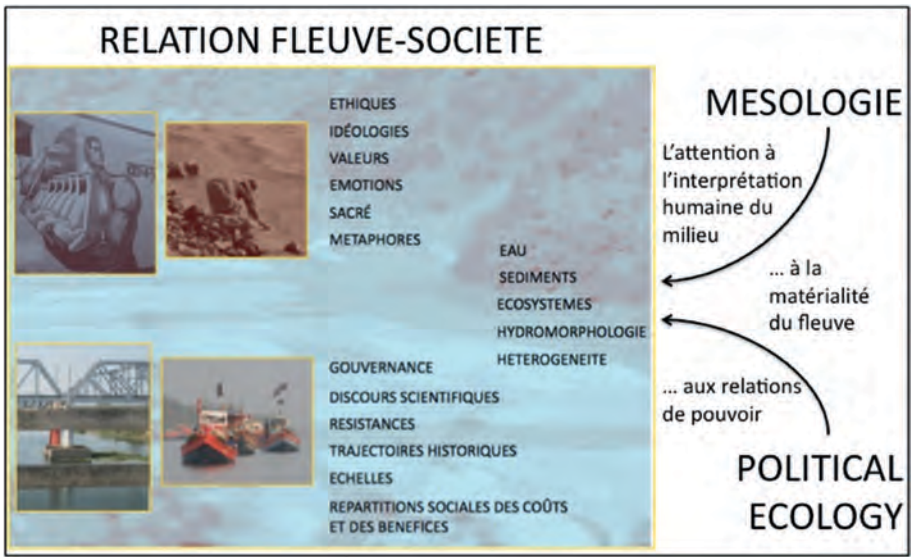

Figure 3 : Combiner mésologie et political ecology *pour une nouvelle géographie des fleuves.*

[12] Ce sujet a fait l'objet d'un colloque à l'Université de Lausanne les 10-11 avril 2017 (« Vers une spiritualisation de l'écologie ? »), organisé par l'Institut de sciences sociales des religions contemporaines, où il a été notamment question de « *Greening of religion(s)* » et de « *Religion of Greening* » (Adrian Ivakhiv, professeur, Université du Vermont, USA). L'encyclique Laudato Si de 2015, les cérémonies indigènes rituelles qui inaugurent les négociations internationales sur la biodiversité ou encore les réseaux émergents de la « transition intérieure » en Suisse en sont diverses manifestations, détaillées au cours du colloque.

Conclusion

Dans cet article, nous avons souhaité montrer la pertinence d'associer la mésologie aux approches de *political ecology* dans l'étude des relations fleuve-société, afin d'approfondir l'appréhension des enjeux écologiques et de pouvoir, liés à la gestion des fleuves.

À travers le panorama historique de l'étude des fleuves, nous avons dégagé un mouvement de balancier entre mise à distance (époque moderne) et dépendance (époques prémoderne et postmoderne), sur le plan conceptuel, entre fleuve et société. Il est intéressant de rapprocher ces observations des propos d'Élisée Reclus au sujet des dynamiques entre milieu et société dans sa préface à l'ouvrage de Léon Metchnikoff. Selon lui, ceux-ci relèveraient *à la fois* d'une distanciation et d'un rapprochement :

> « *Dans ces rapports* [entre milieu et société], qui *sont la civilisation toute entière, l'homme apprend deux choses, d'ordre contradictoire en apparence : d'une part, il se dégage de la domination absolue de certaines conditions du milieu, d'autre part, il accroît indéfiniment les points de contact avec la nature, et mille choses qui lui étaient jadis inutiles lui sont devenues aujourd'hui nécessaires* » (Metchnikoff, 1889, p. 21).

L'identification de ce double mouvement dans la relation homme-fleuve nous semble particulièrement valide. Il préfigure les aménagements colossaux des vallées fluviales au XX^e^ siècle mais aussi les opérations de « restauration écologique des cours d'eau » qui « manufacturent » les milieux. Nous y lisons également la pluralité des attachements émotionnels et symboliques, voire identitaires, au fleuve. Ces « attachements » peuvent osciller entre indifférence et fusion affective et engendrent une gamme variée de pratiques, de la domination par les aménagements à la vénération rituelle de l'eau du fleuve divinisé.

À ce titre, cette proposition renforce notre volonté d'opérationnaliser l'étude des interprétations éco-techno-symboliques liées aux fleuves pour en dégager les implications sociales et politiques. Une nouvelle « *political ecology* des fleuves » devrait selon nous s'emparer de ce champ d'investigation. Nous nous y attacherons, et notamment autour du fleuve Gange.

Figure 4 : Aux sources du Gange, à proximité du glacier Gaumukh (FLDM, 2016).

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Combining political ecology and mesologie for a new geography of rivers ?

How shall one rethink the integrated management of river basins in the context of the Anthropocene ? The authors suggest a new theoretical framework based on post-positivist geographies for a deeper understanding of environmental, political and social conflicts related to rivers. Thanks to ontological explorations of the object "river" and to a review of river case studies that use a political ecology of water approach, they confirm the potential of combining political ecology with A. Berque's "mesology".

***Keywords** : River, anthropocene, political ecology, mesology, hydrosocial cycle.*

In Richtung einer neuen "Umweltgeografie" der Flüsse: kann man politische Ökologie und Mesologie verbinden?

Wie kann oder soll man den integrierten Problemansatz der Flüsse im Kontext des Anthropozäns neu interpretieren, um die ökologischen, politischen und sozialen Herausforderungen im Zusammenhang mit einem Fluss zu begreifen? Die Autoren schlagen mit einer post-positivistischen geografischen Vorgehensweise den Aufbau eines neuen theoretischen Rahmens vor. Eine Annäherung zwischen Political Ecology und der Mesologie von A. Berque im Lichte einer Fragestellung über das «Objekt» Fluss und als Folge auf die gezielten Arbeiten der «Political Ecology of Water» wird hier dargelegt.

***Stichwörter**: Fluss, Anthropozän, politische Ökologie, Mesologie, soziohydrologischer Kreislauf.*

APPENDIX 2: PUBLISHED VERSION OF *WHEN HYDROSOCIALITY ENCOUNTERS SEDIMENTS (LOWER GANGES BASIN): TRANSFORMED LIVES AND LIVELIHOODS IN THE LOWER BASIN OF THE GANGES RIVER*

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When hydrosociality encounters sediments: Transformed lives and livelihoods in the lower basin of the Ganges River

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Abstract

The hydrosocial cycle is a central analytical framework in political ecological approaches to water. It helps foreground multiple and subtle interactions between water and society, culture and politics. However, to date it has dealt little with matters other than water flows. In river contexts, biotic and abiotic components play critical roles in the way people engage with and make a living out of rivers, beyond water. This article aims to advance the hydrosocial framework with a deeper consideration of the materiality of rivers. To initiate this approach, the focus is here on sediments. Lives and livelihoods connected to river sediments remain both officially and academically under-explored. This certainly applies to the context of the Lower Ganges basin whose active channels transport huge loads of sediments mainly originating from the Himalayan slopes. Building upon an environmental history perspective and drawing on three spatially nested cases in West Bengal, India, the paper analyses instances of water-sediment-society interactions. The general case study presents colonial state interventions in the Lower Ganges basin waterscapes. The second case study zooms the focus on the 2 km long Farakka Barrage. These explorations reveal how an 'imported' conceptual land-water divide infused those interventions, leading to unforeseen effects on riverine lives and livelihoods. Focusing on Hamidpur *char*, situated few kilometres upstream of the barrage, the third case study recounts the contemporary efforts of local communities to obtain revision of administrative decisions unable to deal with 'muddyscapes'. Finally, the paper engages with recent debates on the concept of hybridity in land-water nexus to reflect on the specific meaning and role of sediments.

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Keywords
Political ecology, river basin, sediment, hydrosocial cycle, environmental history

Highlights

- Hydrosocial research tends to focus on water flows.
- In river contexts, one must also engage with other material elements like sediments.
- Reflecting on sediments leads to questioning categories like land, water and hybridity.
- Hegemonic conceptual divides exist between water and land, ignoring sediments.
- Cases from the Lower Ganges basin show impact of such divides on waterscapes and livelihoods.

Introduction

A large corpus of physical geography studies shows how sediments play a key role in fluvial geomorphology, river ecology and erosion or flood hazards. Despite a considerable growth in the study of sediment transport in rivers from the 1950s, in many cases, river management still focuses on flow regime at the expense of sediment regime (Wohl et al., 2015). Similarly, lives and livelihoods connected to sediments remain often both officially and academically under-explored. However, in geography and anthropology, theoretical and empirical explorations of lives in shifting land(water)scapes like meandering rivers (Abizaid, 2005; Coomes et al., 2009), temporary river islands (Lahiri-Dutt, 2014; Lahiri-Dutt and Samanta, 2013) or in deltas (Krause, 2017a, 2017b; Sultana, 2010) increasingly document the role of sediments in the forms and dynamics of river-society interactions.

This article aims to advance the understanding of socio-natural processes around rivers with a renewed perspective on the materiality of rivers, notably in incorporating sediments. To do so, we mobilize the political ecology of water, and particularly the hydrosocial framework that we enrich with insights from critical physical geography. The hydrosocial cycle as defined by Jamie Linton and Jessica Budds, 'is a socio-natural process by which water and society make and remake each other, over space and time' (2014: 175). Hydrosocial analyses aim to reveal intertwined 'flows of water and power relations' (Budds et al., 2014), while studying material and discursive dimensions of water. In a related vein also linked to political ecology, the critical physical geography approach engages centrally with biophysical processes while calling for the greater attention to power relations (Lave et al., 2014).

We chose to explore this approach in the context of the Lower Ganges basin, in the West Bengal State of India. The Lower Ganges basin is an interesting case for pushing hydrosocial theory as it combines extreme features: situated within the Ganga-Brahmaputra Delta, the product of two of the world's most silted rivers and their distributaries, it is also one of the most densely populated deltas. Highly altered by terrestrial and riverine infrastructure including railway lines, roads, embankments, ports or barrages, the terrain is crisscrossed by intense human activities dependant on rivers. It is also increasingly vulnerable to climate change. The Lower Ganges basin is shaped by cyclones, coastal storms, river-induced floods, erosion and accretion phenomena, but also, indirectly, by ways of thinking about the river. The large dams and high embankments that were developed in the country since India's independence were the result, as geographer Kuntala Lahiri-Dutt puts it, of 'objectification of rivers, depriving them of their right to spread over space [...]. The sense of oneness with rivers and attachment to them was replaced with the sense that a river, like a wild horse, needs

to be ''harnessed'', ''tamed'' and ''controlled''' (2000: 2399). Ruling paradigms, economic expectations and power relations around water, from close to far distances (notably in the case of the British Empire), shaped Lower Ganges basin's rivers and waterscapes that in turn shaped people's livelihoods, rulers' decisions, institutional configurations and even political movements or ideas. Thus, this part of the Indian Bengal basin, through its history and up to its contemporary dynamics, fully embodies the concept of hydrosocial cycle.

In the particular context of *chars* (the silt islands, sandy shoals or bars that frequently emerge and disappear within the riverine channels of the basin), human engagements with sediments are critical. As shown by Lahiri-Dutt and Samanta (2013), though fragile, unstable, and at risk of disappearance, these places remain attractive possibilities to some, generally marginal, human communities, as they are fertile. *Choruas* (inhabitants of *chars*) put all their efforts in making a living from these stratified silt/sandy lands that often turn into muddy waters in monsoon seasons or get entirely submerged in one flood. These *chars*, which evolve not as landscapes or waterscapes, but as composite *muddyscapes*, exemplify instances of water-sediment-society dynamic relations.

The paper consists of five sections. Following this introduction, the next section discusses the existing literature and justifies the relevance of proposing to enrich hydrosocial analyses in river contexts with a focus on sediments. Then, we introduce the Lower Ganges basin and three nested cases where water, sediment and society interact. The Lower Ganges basin case and the zoomed focus on the construction of the Farakka Barrage reveal how colonial and post-colonial state interventions dramatically altered the natural deposition pattern of its alluvial sediments and disrupted *Choruas*' livelihoods as well as socio-political equations. With a greater zoom in Malda district, upstream of the Farakka barrage, the third case recounts the contemporary efforts of *Choruas'* communities to obtain the revision of administrative decisions unable to deal with 'muddyscapes' (*Hamidpur char*). In the subsequent section, further insights are drawn from the incorporation of sediments into the hydrosocial framework. We also engage with recent debates on the concept of hybridity in the land-water nexus. The last section wraps up the argument, raising possibilities for further lines of inquiry.

Confronting the hydrosocial literature with river sediments

The materiality of rivers

Our approach positions itself within the 'political ecology of water', a critical literature that studies the social and political dimensions of water (Loftus, 2009). This literature mainly criticizes apolitical analyses of water-related phenomena. Case studies related to drought for example show how power relations affect access to water as well as scientific knowledge produced about water, while water scarcity gets 'naturalized' in discourses (Budds, 2009; Kaika, 2003; Mehta, 2011). In this vein, the concept of hydrosocial cycle emerged within the field to emphasize the *internal* and *dialectical* relation between water and society, drawing attention to 'how water is made known and represented, and its effects' (Linton and Budds, 2014: 177). Such analysis may for example reveal the political processes behind the scientifically produced 'Minimum Flow Requirements' of the Garonne River in south-western France and their effects on water control decisions (Fernandez, 2014).

Conversely, the role of the materiality of water is also acknowledged in this framework. 'We contend that the hydrosocial cycle comprises a process of co-constitution as well as material circulation' (Linton and Budds, 2014: 170). In Linton and Budds' terms, water materiality is characterized by its 'agential role' in hydrosocial relations (2014: 176). For example, hydrologic processes produce material flows of water but may also be agents of

social, economic or cultural reorganizations (like after a severe flood); other studies also showed the agential properties of assemblages of water and technology/infrastructure (Barnes, 2012; Birkenholtz, 2009; Swyngedouw, 2007). Political ecology of water, and within it, hydrosocial analysis, have been applied to study rivers and river basins (Alatout, 2012; Bakker, 1999; Matthews, 2012; Molle, 2005; Norman and Bakker, 2009; Peterson, 2000; Sneddon and Fox, 2006; Vogel, 2012 and for hydrosociality, Bakker, 2000; Boelens, 2014; Bouleau, 2014; Bourblanc and Blanchon, 2014; Budds, 2009; Budds and Hinojosa, 2012; Fernandez, 2014; Hommes et al., 2016; Mollinga, 2014; Perreault, 2013; Swyngedouw, 2007). However, to date, we observed that in river contexts, hydrosocial studies often restrict considerations of the materiality of rivers to water flows. For instance, the sediments that rivers carry, or the biodiversity they shelter, are often not considered or only briefly taken into account. The perspectives of dominant actors and available data often promote a view of river waters as a liquid resource only. Lack of available data on river ecosystems may be a constraint for researchers. For example, in their hydrosocial study in Peru, Budds and Hinojosa (2012) mentioned that the impacts of mining extraction on the ecology of headwaters are scarcely documented. Mollinga's (2014) study of an irrigation canal in south India also corroborates this argument as he showed that singularising the meaning of river water in productive terms was the result of a state strategy.

Some scholars however mobilize more than water flows in their analyses. Bouleau (2014) highlights the mutual shaping of scientific categories used to describe hydrosystems, like bioindicators such as diatoms or habitats such as wetlands, and the waterscapes themselves; Perreault (2013) shows the significance of distinguishing different 'forms of nature', like sediment and water, and different qualities, like clean or contaminated, to reveal instances of local communities' dispossession in a mining region of the Bolivian Andes. This attention to materiality is also stressed by Birkenholtz (2016) in his study of water transfers from rural to urban areas in Rajasthan, showing that water's variability, spatially and temporally, affects hydrosocial relations as well as capital accumulation.

Drawing on these works and on critical physical geography that calls for integration of physical and human geographies while acknowledging the politics of environmental science (Lave, 2015), we seek to enrich hydrosocial analyses with greater attention to materiality of rivers 'over space and time'. In this regard, we choose to focus here on the sediment component of rivers.

Looking at sediments

Sediment regimes are crucial to aquatic and riparian ecosystems (see Wohl et al., 2015). Unintended ecological effects occur if sediment supply and transport are overlooked in river management (Poff et al., 2006). These findings from physical geography, sedimentology, fluvial geomorphology, hydrobiology or biochemistry on hydrosystems, confirm the importance of sediment circulation in river systems.

Building on these works, we propose to more fully incorporate sediment in hydrosocial analysis, drawing on a body of recent, critical literature that emerged in anthropology and geography dedicated to *muddy terrains*, or those places where sediments, rivers, and societies intersect (Cortesi and Carmago, forthcoming; Krause, 2017a; Lahiri-Dutt, 2014). We notably mobilize useful concepts and insights from Franz Krause and Kuntala Lahiri-Dutt for our approach.

Krause (2017a) proposes an 'amphibious anthropology' to adequately account for lives in deltas. This approach encompasses concepts of wetness (recognizing the spectrum of realities

between dry and wet, and their local importance), volatility (instability and fluidity of humans and non-humans' interactions) and rhythms (analysis of clashing and/or corresponding ecological and social interrelated rhythms). These latter two concepts rightly reflect the high variabilities of sediment regimes; moreover, 'rivers respond to changes in water and sediment inputs at varying temporal and spatial scales, but such scales can be substantially different for sediment and water' (Wohl et al., 2015: 359). Thus incorporating sediments leads to a greater attention to temporalities and rhythms (Krause, 2017b).

Lahiri-Dutt's work has been a major inspiration for the present article. Lahiri-Dutt strongly argues for the need to '[reconsider] one of the foundational binaries [of geography], that of land and water' (2014: 1). Engaging with the concept of hybridity beyond mere material forms (or a simple mix of water and land), she reworks the 'wet theory' conceived by anthropologists like Appadurai and Breckenridge (2009). One of her aims is to bring 'more fluidity in speaking of hybrid environments' (Lahiri-Dutt, 2014: 2), noting that most of geographical metaphors are related to land only. As an instance of not excluding complexities or ambiguities, she further invites critical geographers 'not to give up mud and silt in favour of either land or water' in their explorations of hybridity (Lahiri-Dutt, 2014: 8), drawing empirical insights from the Bengal context. In the section What do we miss when we miss sediments? Rethinking hybridity, we therefore engage with recent debates on hybridity to further reflect on the meaning, place and role of sediment in human geography.

Incorporating sediments in the hydrosocial cycle

In order to better guide our empirical investigation, our proposition is to revisit the model of the hydrosocial cycle proposed by Linton and Budds (2014), with its three components: (1) H_2O, standing for water's materiality; (2) social power/structure and (3) technology/infrastructure. In this conceptualization, other aspects like discourses, ideas, representations of H_2O or knowledge are internalized in what the authors call 'water', at the centre of the cycle (see Figure 1).

In our proposition of a materially enriched hydrosocial cycle, we instead articulate four components. Referring here to the dialectical approach that infuses the concept (Harvey, 1996; Linton and Budds, 2014), we understand these components as intimately connected processes, sustaining, undermining, shaping or disrupting each other into new configurations, though belonging to different levels of abstraction and to different space-time dimensions (including the distinction between experienced or external spatialities and temporalities). The four components we propose are: (1) Meanings and interpretations (including knowledge, scientific and/or local) of *land* and water ('muddyscapes'); (2) *Land* and water-related governance and power relations; (3) Resource (here water and *sediment*) use and exchange patterns; (4) Physical and biological processes, partly mediated or affected by technology. The seemingly prominence of social processes (3 out of 4) over physical processes do not refer to a quantified representation of the relative importance of those processes. The idea here is rather to make the possibilities of interactions among varied social dimensions and physicalities more visible. Figure 1 aims to illustrate these components with a limited choice of key words.

As in Linton and Budds' conceptualisation, each component exerts actions and eventually brings changes to other components affecting the whole cycle. As a consequence, the cyclical process does not follow a regular path among components; the idea of a cycle is however kept as all components of the cycle finally become affected along a historical trajectory, as shown in the empirical section that follows.

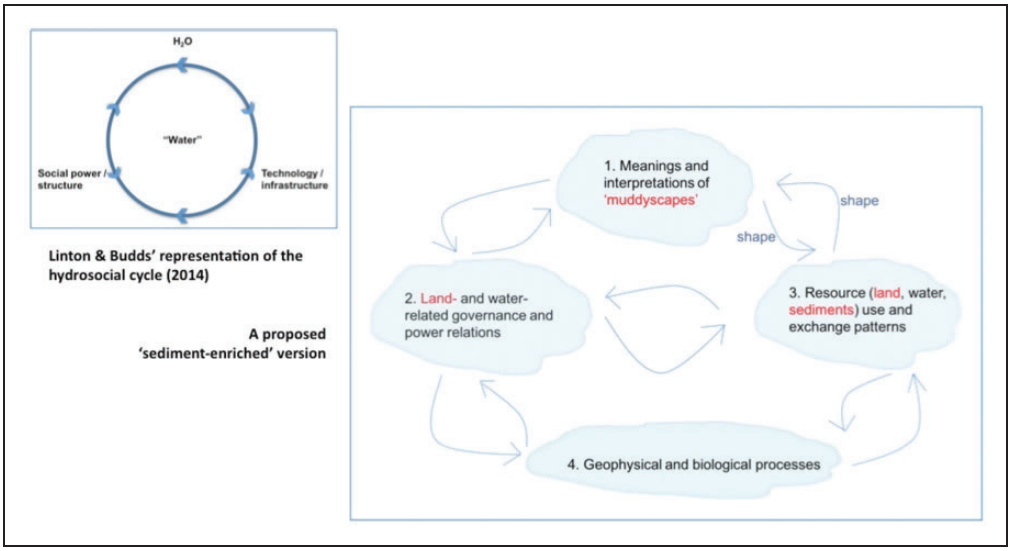

Figure 1. A 'sediment-enriched' hydrosocial cycle.

Our aim is now to illustrate why sediments matter in river-society dynamics. The next section presents three cases in West Bengal, India. Our case studies are nested in temporal and spatial scale from large to small: the general environmental history of the Lower Ganges basin, the Farakka barrage construction event and its consequences, and Hamidpur *char* that is located about 11 km upstream of Farakka barrage.

In each of these cases, we shed light on mutual interactions and shaping processes among the four (proposed) components of the hydrosocial cycle (see Figure 1). We particularly study the role of conceptual frames of thought (i.e. component 1) and how *Choruas*, as well as authorities, adjust and react to such 'moving terrains' (components 2 and 3). We incorporate physical processes (component 4) through qualitative descriptions, rather than through quantitative research on sedimentation and erosion, for such work in the Ganges basin lacks sufficient data (see notably Wasson, 2003; Singh, 2008a). In this way, we depart from a true socio-sedimentological case of the kind that critical physical geography would call for. Through our cases, we focus instead on how the land/water divide worldview has affected people's living conditions in the Lower Ganges basin until now.

The Lower Ganges basin: Transformed lives and livelihoods

Introducing the lower basin of the Ganges River

> . . .a riverine plain that is part land, part water, but is neither in its entirety. . .
> from the breadth of the delta mouth
> to the microcosmic worlds of silt islands or chars that lie within the riverbeds.
>
> (Lahiri-Dutt, 2014: 4)

Shared by India and Bangladesh, the vast alluvial plain of the lower basin of the Ganges River is characterized by an intricate network of interlacing channels and

abandoned meanders, as well as marshes and occasional higher lateritic tracts. The Ganges–Brahmaputra delta is a tide-dominated delta with highly turbid estuarine channels. Deposition processes characterise the delta, as the river slope is only about 4 cm/km (Singh et al., 2007). The active Ganges channel upstream of the delta is highly sinuous, making large meander loops within a 20–30 km wide valley (Singh, 2008a). Two hydrological phenomena dominate. First, there is huge seasonal variation in flow discharges due to the monsoon regime: monsoon flows (July–September) reach 10 to 100 times non-monsoon flows (Singh et al., 2007). Second, the river transports a considerable amount of sediments to the delta area (600 to 1200 million tons/year bedload, Wasson, 2003), mainly from upper Himalayan highly erodible slopes (Wasson, 2003). Singh et al. (2007) note that about half of the sediment discharge to the world's oceans originates from the rivers of South-East Asia due to the morphodynamic evolution of the Himayalan range. Monsoon flows thus carry about 90% of the annual sediment load into the delta region (Singh, 2008a). As a consequence, in monsoon period, 'bankfull discharges result in an enormous spontaneous transportation of sediments to the Bay of Bengal along with changes in the river channel morphology' (Singh et al., 2007: 157). The Ganges riverine system therefore remains dynamic, with bank erosion, accretion, and changing courses of rivers (Rudra, 2014).

Our empirical focus is on the Indian part of this geographical unit, within the state of West Bengal. The river Ganges enters the West Bengal State in the Malda district, with the Rajmahal Hills on the right side. After some 35 km, at Farakka, the Ganges bifurcates[1] into two major branches, the Padma River (in a south-east direction, towards Bangladesh) and the Bhagirathi River (to the south, towards the city of Kolkata). In the centuries leading up to the Farakka Barrage, the Ganga–Padma River was the main branch. The slowly decaying Bhagirathi River used to birfucate about 40 km downstream, near Mithipur, Murshidabad district. However, the commissioning of the Farakka Barrage in 1975 on the Ganges, a diversion structure designed to increase the flow in the Bhagirathi River, put an end to the natural degeneration of that channel. The Bhagirathi River is now constituted of a 39 km long feeder canal that is derived from upstream of the barrage, and joins the sea about 300 km downstream. In its tidal stretch, notably in Kolkata, the river is named Hugli River. The river finally merges with the Indian Ocean near Sagar Island, on the western side of the Sundarbans, a complex of coastal islands. Dynamic phenomena of coastal erosion, accretion and submersion continuously shape and reshape these deltaic islands or tidal bars (see Figure 2).

The dynamicity and the changing courses of the Bengal basin's rivers also lead to the creation of channel bars or 'sandy islands'. Locally termed as *chars*, these silted/sandy bars frequently emerge or disappear among riverine channels, as the sediment is deposited then gradually moved downstream. The distinction between suspended load and bedload is difficult to make in the Lower Ganges basin: Ganges River sediments show a strong overlap of grain size between bed load and suspended load deposits (Singh, 2008a). Both bed and suspended load consist of mainly fine to very fine sand; the suspended load also includes a high proportion of silt and clay. In particular, very fine sand and silt-clay fraction constitutes the sediment of the Bhagirathi (Singh, 2008a). Nearly 80% of bedload is transported as 'graded suspension' due to bottom turbulence during monsoon flows (Singh et al., 2007). A large amount of suspended load, rich in silt, is transported, then deposited on *chars*: 'several centimetres thick muddy sediment is found deposited on top of channel bars after each flood, essentially representing the suspended load' (Singh, 2008a: 354). The *chars* are made of deposited sand and silt strata, and, as a consequence, they are highly vulnerable to fluvial erosion processes (see Figure 3).

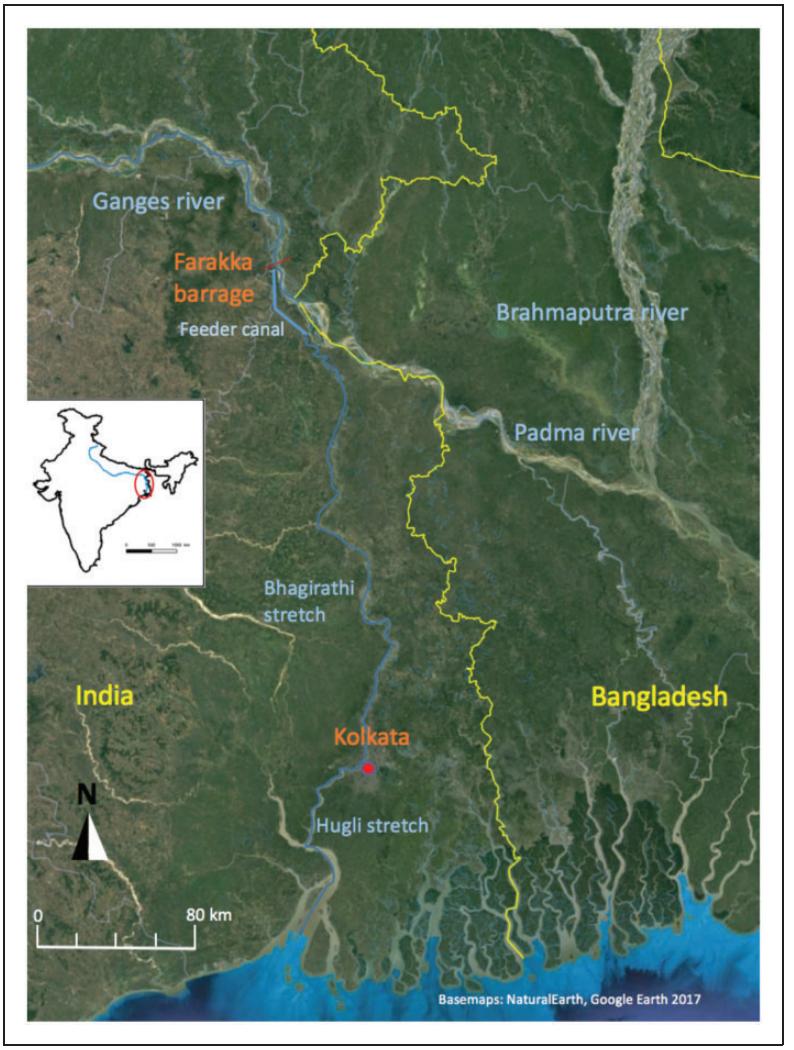

Figure 2. Schematic map of the Lower Ganges basin.

Though temporary, and at risk of floods and erosion, many of these *chars* are inhabited by *Choruas* who farm and reside there. Richer in silt than coastal *chars* (where this term is also used), the riverine *chars* are fertile. They are rendered attractive by the difficulties of accessing agricultural land, as in India overall.[2] The entire delta is highly populated (in West Bengal only, there are about 57.2 million inhabitants in the nine districts through which the Bhagirathi/Hugli River passes through;[3] 4 million in the Malda district alone) with human density average at district level in so-called rural areas up to 1700 people/sq · km (Hoara district, Census India, 2011).

The next section studies water-sediment-human dynamic relations in the Lower Ganges basin. Inspired by the Indian environmental, and more specifically water history literature (Mukherjee, 2018), this retrospective situates the Farakka Barrage project within two generic 'moments' in the history of the Lower Ganges basin: the colonial and the post-colonial periods.

Figure 3. Nirmal *char* in Murshidabad district, West Bengal (India).

Why sediments matter, case 1: From land/water divide to increased erosion in colonial era

This section narrates shifting configurations of the hydrosocial cycle, in relation to the disruptions introduced by colonial rulers on water-sediment-society dynamics. At the end of each paragraph, we briefly note which of the cycle components presented in Figure 1 are involved. As shown below, these material and discursive practices were largely infused by a modernist paradigm that conceptualized land and water as strictly separate entities (the land/water divide) and that restricted rivers to productive *water* channels (D'Souza, 2009).

In the 17th century, just before the establishment and consolidation of the East India Company in Bengal, the dominant physical features of the basin were similar to modern ones: monsoon-type climate, silt-rich lands suitable for rice and other cultures and geomorphic dynamicity of rivers and channels (Bernier, 1981). Overflow irrigation was widely practised (Klingensmith, 2007). In this system, the nutrient-rich, silt-laden monsoon floodwaters were distributed, watering and more importantly fertilizing fields, spreading fish over the countryside and sweeping away mosquitoes (Klingensmith, 2007). Floodwaters were directed through a system of wide, shallow canals (*khals*) with minimal embankments (*bunds*); during the monsoons, breaches were made to these canals to allow flooding (Willcocks, 1930). As an outcome, in the 17th century, the French traveller

François Bernier praised the prosperity of the region, stating that Bengal is richer than Egypt, producing abundant surpluses in rice and sugar and attracting foreign traders from many parts of the world for its crops, spices, silk clothes and other goods (Bernier, 1981).

The colonial era introduced major changes to existing river-society relations. The latter were characterized by *rapports d'accommodation*, or 'relations of adjustment' (Reclus, 1889, our translation) or 'dancing with the mood of the River' (Lahiri-Dutt and Samanta, 2007). The British rulers carried with them the classical modern western paradigm that considered the environment as a mere externality (Berque, 2014) that should be tapped, in contrast to the pre-modern viewpoint of reciprocal nature-society relations (Chatterjee, 2017). For instance, Colonel Cotton proclaimed in *Report on the Mahanuddy*, 'all deltas require essentially the same treatment' (Cotton, 1858: 3). This is an example of components 1 and 3 (see Figure 1) mutually shaping each other.

Moreover, the colonizers introduced a land/water divide (Bhattacharyya, 2018; D'Souza, 2009; Lahiri-Dutt, 2014) or a sharp conceptual separation between river water and its sediments. In the modernist European tradition, notably since early 17th century, land-water hybrids like swamps, silt islands, and sandbanks were considered treacherous, leading to innumerable drainage, reclamation and embankment campaigns (Cosgrove, 1990; Morera, 2011). This mental framework was applied to colonial territories where modern hydraulic techniques (using pumps, dredging devices, locks and sluices) were used to transform precarious waterscapes into durable landscapes (see for example Bhattacharyya, 2018). While 'land exorcised of water' is transformed into property, fostering revenue generation and management, flowing waters were valorised in engineering visions to generate resource output (D'Souza, 2006: 3). Rivers were seen as liquid flows and represented in financial units. For instance administrator Trevelyan mentions in *On Godavari Irrigation and Navigation*, about monsoon flows: '4,20,000 cubic yards of water/hr flowed into the sea at the rate of Rs. 500/hr i.e., 12,000/day for 240 days and it gave Rs. 2,880,000' (Rao, 2011: 149).

The British colonizers transformed the ruling paradigm towards a 'rule for profit', subordinating the region to colonial capitalist relations and to British administrative and financial needs. With their smooth liquid surfaces, waterways were designated to serve as the cheapest and quickest means of transportation (Reynard, 2005). As in Orissa's Mahanadi delta, watercourses 'calibrated as arteries for trade, however, principally serve as technical arrangements to circulate the economy of land' (D'Souza, 2009: 4). In accordance with this 'colonial hydrology' (D'Souza, 2006), loaded with 'imperial science' (Gilmartin, 1994) and 'technochauvinism', rivers were channelized, shortened, dredged, embanked and straightened; numerous meanders, bends, loops, braids, adjoining wetlands, marshes, swamps and other forms of water-soil admixtures were eliminated (D'Souza, 2009). Newly excavated canals were constructed,[4] with high banks that impeded easy overflow of water as well as silt deposition.

Many socio-economic consequences unfolded. An embankment regime was established. While the maintenance of overflow irrigation had previously been paid out of the general land tax and was available to all cultivators free of additional charge, the new arrangements expected peasants to pay for water use and for embankment works. The age-old overflow irrigation practiced in the Lower Ganges basin was replaced by perennial irrigation (D'Souza, 2002, 2006; Mishra, 1997, 2008; Singh, 2008b, 2011). From community-managed small-scale structures, the overall irrigation system became centrally designed and engineered by scientists and technocrats under the aegis of the Irrigation Department (Gilmartin, 1994; Weil, 2006), with a clear neglect of sediments' roles and benefits.

Authorities perceived floods as an obstacle restraining routine and regular revenue collection, especially after the Permanent Settlement in eastern India (Allen et al., 2017). A flood (water/silt) dependent agrarian regime transformed into a flood vulnerable landscape (D'Souza, 2002).

With the continuous extension of fixed embankments (dikes created by railway lines, road networks and further for flood protection itself), the flood situation only worsened with time; some places got regularly 'trapped into water' for long period of time, affecting lives and livelihoods of the inhabitants (Mishra, 2008). On the other hand, the British rulers started to consider *chars* as land or assets as shown in the introduction of the *Bengal Alluvion and Diluvion Act* (BADA) act of 1825. In this act, the key factor to establishing land rights in the court of law was for instance the payment of rent, even on diluviated land. Massive survey operations were also initiated to produce cadastral maps for revenue survey lists (or *khatian*s).

Why sediments matter, case 2: The Farakka Barrage or a new cycle of disruption

This section focuses on the Farakka Barrage project that created a major disruption of the hydrosocial relations in Bengal with far-reaching consequences spatially (up to Bangladesh) and temporally (up to today). For our analysis, we however focus on river-related sedimentation and erosion issues in India.

Conceived during the colonial times, but implemented by Indian authorities in the post-independence period, the Farakka Barrage initiated a new cycle of disruption within the Lower Ganges basin. This huge infrastructure, among the longest barrages in the world (2.6 km long), was initially designed to address the recurrent and massive siltation of the Kolkata Port and to improve the navigability of the Hugli River. Sediments were perceived as a problem and 'clear water' as the solution to generate revenue through riverine trade and transportation. Between 1853 and 1946, British experts periodically reiterated the idea of a barrage on the Ganges near Jangipur with a feeder canal to bring water surplus to the Bhagirathi river (Ministry of External Affairs, 1978; Mukherjee, 2011a). It is interesting to note here that the Boundary Commission under the Chairmanship of Cyril Radcliffe also considered the immense importance of the Farakka Barrage and hence deviated from the principle that contiguous Muslim majority areas should form Pakistan. Murshidabad (with a Muslim majority), where Farakka is situated hence remained in India and in exchange a non-Muslim majority district of Khulna went to the former East Pakistan (Ministry of External Affairs, 1978). Re-appropriated by the Indian authorities, the Farakka Barrage Project then began in 1962 and was completed in 1971. Between 1971 and 1975, the 39 km long feeder canal was excavated and the project was finally commissioned in May 1975, becoming a national emblem of Indian technocracy and sovereignty.

However, the outcome of the project related to sedimentation processes was largely ill-planned. Notably, induced discharge from the barrage has not been able to reduce sedimentation at the Kolkata Port; the annual quantum of dredging in the shipping channels of the Kolkata and Haldia Ports' area has actually increased during the post-Farakka period (Rudra, 2003). The barrage has disrupted not only downstream water flow but also river sediment movements in diverse ways. The barrage has been contested by Bangladeshi authorities due to the contentious sharing of Ganges water between India and Bangladesh[5]; it has also been challenged within India by activists, politicians and local residents (press or website reports[6] and field interviews). These actors notably denounce the amplitude of sedimentation changes and their consequences in the two

channels (Ganges/Padma and Bhagirathi rivers), upstream and downstream. In addition, because the barrage gates are never fully open (in order to stabilize the expected upstream pond water level, even during most of monsoon season), sediment deposition has increased, resulting in the formation of several shoals upstream of the barrage. These shoals have led to increased meandering and sinuosity of the river as well as lateral flow instability (Mazumder, 2017; Thakur et al., 2012). The ecology of the main channels, upstream and downstream, has also been transformed due to flow velocity reduction and abiotic changes (temperature and turbidity); these changes have contributed to modifications of fish diversity and abundance, notably the reduction of a high-value commercial species (Hilsa fish) population (Indian Institutes of Technology, 2012: 11–12) as well as the decrease of the emblematic Ganges dolphin (Sinha, 2000; Sinha and Kannan, 2014).

Since sedimentation has increased upstream, the riverbed has been raised, intensifying lateral erosion of sandy banks (Thakur et al., 2012). As the upstream right bank is of hard rock at the Rajmahal hills area, deep erosion mainly occurs on the left bank. As a result, for instance, in Malda district, the river channel was displaced to the left by 7 km between 1923 and 1999 (Mazumder, 2017) and more than 1 km between 2003 and 2005 within the Kaliachak-II block, erasing some villages (Thakur et al., 2012). Repeated floods have weakened soil structure of the banks. On many occasions, marginal embankments or spurs have been breached, causing higher flood damages. In the 1995 and 1998 floods, 450 people died and properties worth about 10 billion INR were damaged (Mazumder, 2017). In Murshidabad district, downstream of the barrage, erosion patterns were disrupted leading to destruction of 'mature' *chars,* already inhabited and cultivated (Rudra, 2003). Due to the increased emergence, submergence, re-emergence and re-submergence of *chars*, *Choruas* suffer from what has been called a 'SDRR' (settlement>displacement>re-settlement>re-displacement) syndrome, with some people being forced to move more than four times, and even up to 16 times within a time span of 15 years with a relative indifference from authorities (Mukherjee, 2011b).

Why sediments matter, case 3: Hamidpur char, West Bengal

The case of Hamidpur *char* in Malda district briefly captures some reactions and political initiatives of local *Choruas* towards these moving 'muddyscapes'. Our aim here is to narrate a story where water-sediment-society relations and processes not only generate uncertainty and fragility, but also zones of possibilities.

We visited this *char* and its inhabitants several times in 2010 for a study on livelihoods and ecosystem services, then again in July 2017 for the purpose of this research. We also visited other *chars* in the Murshidabad district. We travelled in pre-monsoon period, where one has to walk kilometres (no vehicle apart from tractors may drive on the thick sand layer) on sandy land, sometimes cultivated with underground water use or sometimes bare; we also travelled in monsoon or post-monsoon periods, when only small boats or ferries allow one to reach destinations and when green and dense fields of jute or rice demonstrate the fertility of the plain's soils (see Figures 4 and 5).

We interviewed local administrators at district and local levels (district magistrate, block development officer and staff, state delegate to *Gram Panchayat*, i.e. the local council of the 'village'). We consulted relevant local documentation in administrative offices (reports and maps). To complement these sources of information, we had on-site discussions with *Choruas* engaged in public activities (member of *Gram Panchayat*,

local coordinator of the West Bengal State's *Nirmal Bangla* programme, representative of the *Gram Panchayat* to the Block Disaster Management team) or in daily activities (women, elderly, farmers, etc.).

In order to illustrate the dialectical co-production of river, sediment and society, and instead of labelling each paragraph as in the previous section, the main features of the hydrosocial cycle in this story, here shifting assemblages of representations and meanings of land and water, technology, materiality of river, uses, institutional arrangements and power equations, are first summed up in Box 1 with 10 main points.

Box 1. Hamidpur *char* case, Malda district, West Bengal.

(1) The post-colonial ruling paradigm, inherited from British representations such as the land/water divide and the preeminence of Kolkata port economics, led Indian national authorities to assert their capability and power through the construction of the Farakka Barrage on the main channel of the river Ganges.
(2) The barrage modified water flows, but affected deposition and erosion patterns within the riverbed as well as lateral embankments' strength.
(3) In the context of embankment and irrigation regimes inherited from colonial times, these changes led to increased flood and lateral erosion, with submergence of some mature *chars* and creation of some new *chars*. This caused displacement and migration of *Choruas* as well as deleterious impacts on people's livelihoods (the SDDR syndrome or settlement>displacement>re-settlement>re-displacement, see Mukherjee, 2011a).
(4) In response, authorities could not/did not want to deal with these uncategorized 'muddyscapes', neither fixed land nor water, subject to seasonal changes.
(5) People were refused welfare program support as their land, and their official identity attached to it were lost while the new *chars* retained the status of water-logged non-revenue land, thus 'administratively orphans'.
(6) In reaction, grassroots movements emerged in the Malda district to build a political force to push for recognition of *Choruas*' rights and fight administrative decisions.
(7) The discourse of the *Choruas* got strengthened by scientific arguments developed by scholar-activists like Kalyan Rudra about the impact of Farakka Barrage on the sediment regime.
(8) These movements finally became successful in Hamidpur *char* with the delivery of identity cards, voter cards and ration cards, later with the construction of schools, flood shelters and better roads.
(9) Though the *char* land remains categorized as *shikasti* (i.e. non-revenue land, whose literal meaning is 'defeated'), there is now an effective integration of Hamidpur *Choruas* in local institutions like *Gram Panchayat*, flood commission or Nirmal Bangla (state) programmes.

We now move to the detailed account of this narrative. Hamidpur *char* belongs to Kaliachak II development block, Malda district (see Figure 6). This block, situated 15 km upstream of Farakka Barrage, covers 15,700 ha and a population of about 210,000. The majority of the population are farmers. Among the 15 blocks of the Malda district, Kaliachak II is one of the most vulnerable to floods and river bank erosion. Over 20 years, about a fourth of the block territory has been eroded: 22 villages were completely destroyed and eight others partially swallowed by the River (Kaliachak II BDO, 2007). Besides

Figure 4. Pre-monsoon 'muddyscape', Nirmal *char*, Murshidabad district, West Bengal (courtesy: Koushik Chowdhury).

erosion, floods regularly destroyed crops and housings: within Hamidpur *Gram Panchayat* boundary, eight villages remained waterlogged in 2011, 2013, 2015 and 2016 (Kaliachak II BDO, 2017).

In Hamidpur, people who were affected by land erosion due to the progressive eastward shifting of the Ganges (with massive erosion in 1971 according to local residents) had to migrate to nearby available lands. Thus, they settled in newly emerged *chars* that had appeared on the other bank of the River, in the neighbouring state of Jharkhand. There, they renamed the place Hamidpur to retain the connection with their initial land. However, they were denied any property rights as those areas are considered as *shikasti* or governmental non-revenue land according to the Revenue bill.[7] As in other *chars* of West Bengal, Bihar or Jharkhand, the lives of newly settled *Choruas* remained precarious as migrations caused an oversupply of agricultural labour force, stressing wages to low levels. Moreover, migration, trade and land conflicts, lack of public utilities as roads, communications, hospitals and maternal health facilities were other significant constrains in the *chars* (Dutta, 2011; Lahiri-Dutt and Samanta, 2013; Mukherjee, 2011b). There were also instances of illegal trafficking and other criminal activities as these areas easily remained out of authorities' sight. In the official perspective, these places were emblems of uncertainty and vulnerability and hence unsuitable for any governmental investment (Mukherjee, 2011b) and rehabilitation issues were not considered (Rudra, 2003). Government social and health schemes were not implemented, as people were not registered as proper citizens (Mukherjee, 2011a).

In 1986, a severe flood in Jharkhand drove more than half of the population of that local 'Hamidpur *char'* to move back to West Bengal. People from three to four *mouzas* (groups of

Figure 5. Monsoon 'muddyscape', Hamidpur *char*, Malda district, West Bengal.

villages) however remained in Jharkhand. The newcomers settled on a large and new *char* (about 7 km long and 4 km wide) that re-emerged next to the left bank of the Ganges River, separated from the western mainland by a new small river channel. That area lied approximately at the same spot of mainland Hamidpur's previously submerged areas (interview of Hamidpur GP' executive assistant, July 2017). However, the *Choruas* experienced repeated erosion and floods, notably during 1995, 1998, and 2002. Moreover, being denied rights by West Bengal authorities, they had no identity cards, neither voter cards nor ration cards that allow Below-Poverty-Line (BPL) populations to access rice and other basic commodities at low prices.

In 1998 troubled by the loss of their houses and livelihoods, and against the negligible role of the government, a small group of villagers from nearby Panchanandapur created the *Ganga Bhangan Pratirodh Action Nagorik Committee* (GBPANC). This grassroots movement received the support of action groups and NGOs such as Child Rights and You. These organizations initially aimed at better rehabilitation and relief for the *Choruas*. They then surveyed and mapped the *chars*, in order to initiate the institutionalization of these lands. They also promoted activism towards recognition and assertion of citizenship rights of *Choruas*. Scholar-activists like geographer Kalyan Rudra from Kolkata supported their cause by disseminating studies on Farakka Barrage's responsibility in sediment regime disruptions and its impact on *char* erosion in Malda and Murshidabad districts (Rudra, 2003).

Finally, in December 2010, GBPANC managed to organize a meeting at the Hamidpur *char* itself, in the presence of the Additional District Magistrate of Malda district. Inhabitants

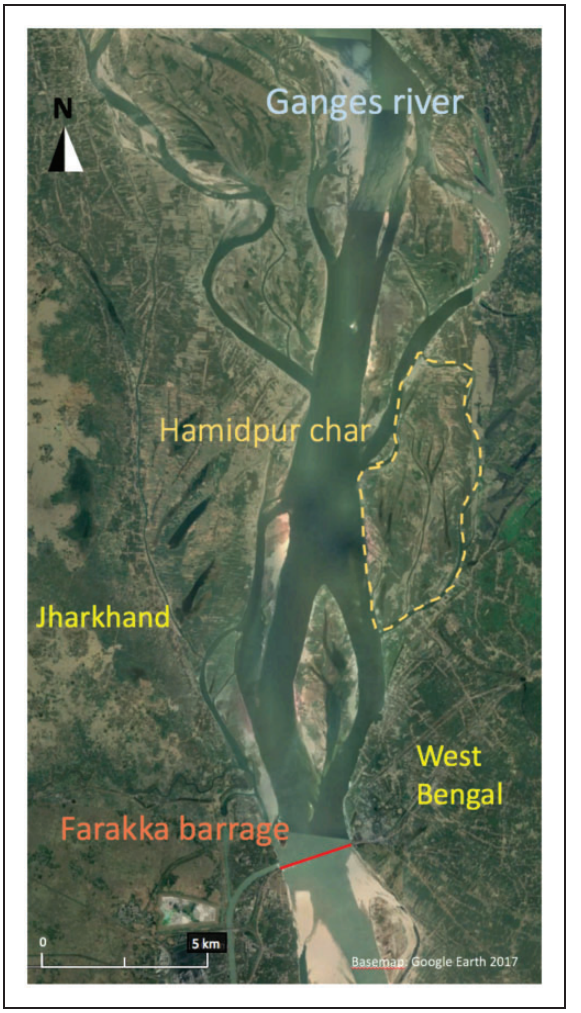

Figure 6. Location map of Hamidpur *char*, Malda district, West Bengal.

were told to bring and show to the administrator their past property entitlements. As a direct consequence of this event, in 2011, *Choruas* got identity cards and voter cards. Two primary schools and a junior school were constructed between 2012 and 2015, allowing children from the *char* to join schools. The *char* got access to electricity in 2015, a tangible sign of marginalization reduction. Since 2014, a woman from the *char* has been elected as Member of the Hamidpur Gram Panchayat. Since *char* residents were recognized officially, this paved the way for political participation (for instance within the local flood commission, or with *Nirmal Bangla* (Clean Bengal schemes, etc.), disaster planning, and delivery of government services (construction of emergency shelters, health programs, etc.).

Between 2005 and 2011, people thought that only classification of *chars* as *payasti* (i.e. revenue land) could lead to access to government schemes and provide official identities to *Choruas*. However, the *char* remains *shikasti* land or non-revenue land; no taxes are then collected on agriculture revenues. As a consequence, thanks to the high

fertility of the *char* soil and according to the head of the Kaliachak II block, 'people are not poor there' (field interview, July 2017).

This particular case of a successful grassroots movement shows the potentials and possibilities of *moving terrain* where flood or erosion may come anytime. In this case, official recognition of the residents' existence and needs has been crucial. However, as the head of Kaliachak II Block explains, Hamidpur *char* is particular in the sense that some easy identifiable land was available for the settlers thanks to re-emergence of land. In contrast, in areas of the Jharkhand-West Bengal border, many *chars* remain like 'orphans': as of now, no decision has been taken to attribute these *chars* to one of the two states. Vulnerabilities of *Choruas* there remain unabated. In 2018, GBPANC was still an active association that defined its mission as promoting a 'complete awareness' about river erosion and the associated problems (GBPANC's website, accessed September 2018). Its aim remained to put pressure on government for conducting technical assessments, understanding empirical realities and crafting policies for welfare of erosion-victims in general and *Choruas* in particular.

What do we miss when we miss sediments? Rethinking hybridity

These Lower Ganges basin cases reveal how sediments transported by rivers are embedded in river-society interactions. We have shown the magnitude of Farakka Barrage's disruption of sedimentation processes in the Lower Ganges basin; and the effect of the submergence/re-emergence of *chars* on Hamidpur *Choruas*' political mobilization to fight against administrative decisions. As observed in these cases, as well as in projects like the Inter-Linking River project promoted by the current Indian government (the general aim of this project is to transfer water from water-rich river basins to water-scarce basins), river sediments are often absent from discourses and ideologies. When deposited or when in suspension, they are often misinterpreted as being only land or only water. They are however involved, along with water, in effective dynamic relations with society, shaping and being shaped by it.

Anthropologist Krause (2017b) argued recently that this land-water nexus does matter, socially and culturally, engaging with a debate around this nexus and the concept of hybridity. He suggests that a geographer's vision like Lahiri-Dutt's (2014) gives too much attention to the spatial aspect of the land-water nexus. According to Krause, it is not so much of a (spatial) hybrid but instead a lived and experienced *temporality*, 'a set of spatio-temporal rhythms of increasing and decreasing wetness and fluidity' that is significant (Krause, 2017b: 1). He illustrates his approach with two ethnographic cases from Northern Europe and shows how the experience of people engaging with their 'in-between environments' (wetland, floodplain) is closely intertwined with 'inherent rhythmicity' of temporalities like seasonal floods or hydropower-oriented manipulations on water level.

Krause's approach points to 'rhythmicity', 'rather than to historicity and futurity' (2017b: 5). In our interpretation, this approach pays less attention to long-term perspectives and political dimensions. In the Lower Ganges basin, these dimensions cannot be overlooked. We showed how the colonial legacy in land/waterscapes and in the land/water conceptual divide still very much infused contemporary dynamics. In such 'post-colonial' landscapes, one should use political and even ontological lenses to address them, as the hydrosocial framework rightly suggests. It is the way we understand the call from Lahiri-Dutt to rethink land as 'aqueous, fluid, spongeous and uncertain' (2014: 3). Beyond referring to outcomes of rhythmic physical processes like tides, floods or seasons, these terms are metaphors. They

oppose colonial/hegemonic perspectives that consider lands as 'terra firma' and that reify a land-water divide.

Krause also engages with the concept of (land-water) hybridity: according to him, this concept often carries implicit spatial focus (it describes a particular environment) and rather reinforces the conceptual divide between land and water (it is thought as a mixture of both, thus '[positing] them as building blocks of the world') (2017b: 2). Krause notably cites Swyngedouw's writings in 2006, where the author takes some distance with the concept of hybridity he initially contributed to develop in political ecology of water: 'the notions of ''hybridity'' or ''cyborg'' are misleading if not radically reproducing the underlying binary representation of the world' (Swyngedouw, 2006: 113). However, Lahiri-Dutt expressly defines hybridity not as the mixture of two environments, but as the expression of flux, uncertainty and the tension between presence and absence: 'sometimes a given environment, sometimes another, sometimes both and sometimes neither' (2014: 18). In that debate, looking at sediments may open new conceptual directions. Sediments are neither water, nor land, they are mineral grains. Depending on the time, on magnitude of flows, on topography, on grain size and on many other subtle factors, they may be subsumed in one or the other. Water, even with suspended sediments, remains aqueous. Sediments may thus be a metaphor of the illusory fixity of categories of land and water, and even hybridity itself, as a third 'thing'. They also bring plurality (the absolute number of grains and their complex chemistry and size distribution), offering in that sense many more possibilities than a singular hybridity. They finally represent what remains to be known (the complexity of physical phenomena determining one mineral grain's trajectory), resisting the attempts to master representation of reality, while – in contrast to hybridity – being in the same time a resource directly in contact with the humans engaged with their environment.

Turning back to the hydrosocial framework, thinking on the roles and meanings of sediments confirms the relevance of paying better attention to materiality over space and time in this approach (Birkenholtz, 2016). It also confirms the significance of the question 'what is water and how is it made known?' that Linton and Budds point to (2014, see also Bouleau, 2014; Linton, 2010). Finally, it complements and confirms the dialectical thinking adopted in the hydrosocial cycle concept that emphasizes processes and relations instead of fixed things and categories (Harvey, 1996; Linton and Budds, 2014).

Conclusion

In this paper, we showed how sediments transported by rivers are intricately interwoven into river-society interactions. The Lower Ganges basin case testifies that sediments are sites of social/physical interactions. Until now, while scientific studies and modelling address some empirical dimensions, these socio-natural realities are not much considered by Indian official authorities. For instance, the draft sediment management policy posted by the Ministry of Water Resources, River Development and Ganga Rejuvenation gives little attention to social issues: no socio-economic assessment is mentioned alongside the scientific studies, mathematical model studies or physical model studies (MoWR, 2017). The draft seems to approve activities like sand and boulder mining, construction of storage reservoirs and riverbank protection/anti-erosion in floodplains, under the condition of respecting sustainable management guidelines edited in 2016. But potentially deleterious impacts on human occupation of downstream or upstream floodplains are not mentioned in the 2016 guidelines for sustainable sand and gravel mining, edited by the Central Ministry of Environment and Forests (MoEF, 2016). Human occupation in floodplains is for example

qualified as 'encroachment' (MoWR, 2017: 2, 6–7) and not as existing occupancy that should be considered in the context of on-going changes and impacts.

The principal contribution of this paper has been to introduce and incorporate sediment within the ambit of hydrosociality. The Lower Ganges basin that is partly land and partly water, and neither in its entirety, inhabited by numerous marginalized communities, exemplifies the significance of incorporation of sediments in water research, not only from the physical [hydrological/geomorphological] point of view, but also from socio-economic, political and cultural aspects. Furthermore, these dynamics of river-sediment-society 'metabolism' extend across long-term temporal conjunctures, as we showed from environmental history.

The hydrosocial approach provides a critical alternative in considering the 'liminal spaces' of hybrid water/lands, reframing them as 'not [only as] lines of separation but zones of interaction… transformation, transgression and possibility' (Howitt, 2001: 240). Sediment-enriched hydrosociality, entering the muddy terrain of Bengal basin, critically interrogates the modernist view of the environment, which 'firmly believed in a watertight divide of water and lands, robbing the rivers of their histories and extracting them from their social contexts of human experience' (Lahiri-Dutt, 2014: 9). There is much more to rivers than just water. Here, we have only pointed to sediments. One could go further to the riverine biota, nutrients or micropollutants; all are socio-natural realities begging for a broader analysis.

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Notes

1. The description simplifies the situation, as the whole system is more complex with temporary disconnected or reconnected distributaries or channels, according to intensities of dry and monsoon seasons and sedimentation/erosion processes.
2. India counted more than 144 millions of landless farmers in 2011, near 55% of agriculture-engaged workers (source: Census India, 2011, http://www.censusindia.gov.in, consulted 5 September 2017).

3. Malda (4.0), Murshidabad (7.1), Nadia (5.2), Burdwan (7.7), Hooghly (5.5), Kolkata (4.5), Howarh (4.9) and 24 Parganas North (10.0) and South (8.2) districts. Kolkata metropolitan region counts about 14 million inhabitants. Figures from Census India, 2011.
4. At the same period, the emblematic Upper Ganga Canal system was excavated for irrigating the Doab region (Uttar Pradesh).
5. Although a water sharing treaty has been signed in 1997 and water data, however not available for the general public, is now shared among an Indo-Bangladeshi commission (Sen, 2017, personal communication).
6. See for example SANDRP report https://sandrp.wordpress.com/2014/11/25/lessons-from-farakka-as-we-plan-more-barrages-on-ganga/ (accessed 21 September 2017), Times of India article, 16 July 2016 http://timesofindia.indiatimes.com/city/patna/Bihar-CM-demands-removal-of-Farakka-barrage-on-river-Ganga/articleshow/53244938.cms (accessed 21 September 2017).
7. Once submerged by a river channel, a re-emerged land remains governmental property and no revenue can be collected from it.

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APPENDIX 3: PUBLISHED VERSION OF *RIVER-HOUSE, RIVER-HOME*

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RIVER HOUSE, RIVER HOME

2017 (3)

by Flore Lafaye de Micheaux

INTRODUCTION: RIVERS, FEELINGS AND EMOTIONS

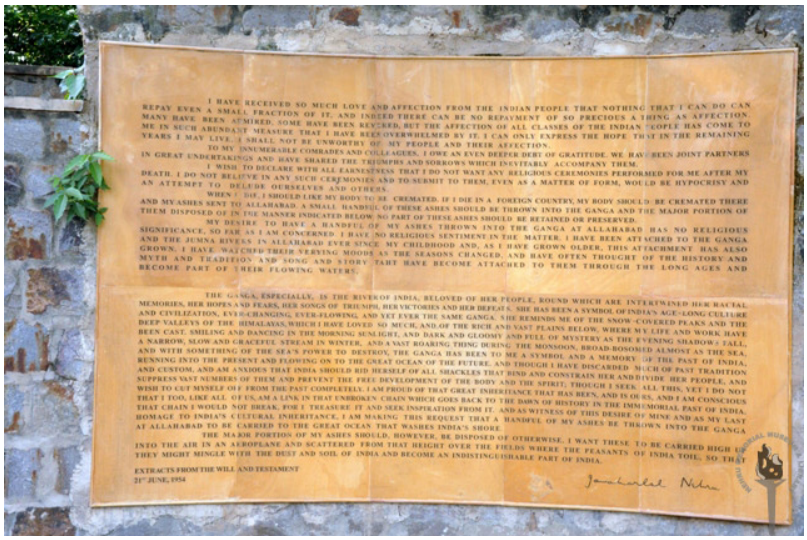
"The Ganga, especially, is the river of India, beloved of her people, round which are intertwined her racial memories, her hopes and fears, her songs of triumph, her victories and her defeats. She has been a symbol of India's age long culture and civilization, ever changing, ever-flowing, and yet ever the same Ganga."

Jawaharlal Nehru, Will and Testament, 1956

The Ganges is more than a river for Hindu believers; it's a deity. Indian myths and traditions abundantly refer to the Ganga divinity, named *Ma Ganga*, or Mother Ganges, by its devotees. Other rivers are also revered in India. Key rituals are thus performed next to rivers, particularly cremations and offerings.

Uttarkashi, Uttarakhand, India (photo by the author)

Jawaharlal Nehru was the first Prime Minister of independent India. He was not a Hindu-religious person, as he himself put it. Secularism was an important concept for him, and he steadily worked at incorporating it into laws and institutions throughout his tenure. However, he requested that his body's ashes, or a small handful of them, be thrown into the Ganges at Allahabad, as written in his published will at *Jawaharlal Nehru Memorial Museum*.



I HAVE RECEIVED SO MUCH LOVE AND AFFECTION FROM THE INDIAN PEOPLE THAT NOTHING THAT I CAN DO CAN REPAY EVEN A SMALL FRACTION OF IT. AND INDEED THERE CAN BE NO REPAYMENT OF SO PRECIOUS A THING AS AFFECTION. MANY HAVE BEEN ADMIRED, SOME HAVE BEEN REVERED, BUT THE AFFECTION OF ALL CLASSES OF THE INDIAN PEOPLE HAS COME TO ME IN SUCH ABUNDANT MEASURE THAT I HAVE BEEN OVERWHELMED BY IT. I CAN ONLY EXPRESS THE HOPE THAT IN THE REMAINING YEARS I MAY LIVE, I SHALL NOT BE UNWORTHY OF MY PEOPLE AND THEIR AFFECTION.

TO MY INNUMERABLE COMRADES AND COLLEAGUES, I OWE AN EVEN DEEPER DEBT OF GRATITUDE. WE HAVE BEEN JOINT PARTNERS IN GREAT UNDERTAKINGS AND HAVE SHARED THE TRIUMPHS AND SORROWS WHICH INEVITABLY ACCOMPANY THEM.

I WISH TO DECLARE WITH ALL EARNESTNESS THAT I DO NOT WANT ANY RELIGIOUS CEREMONIES PERFORMED FOR ME AFTER MY DEATH. I DO NOT BELIEVE IN ANY SUCH CEREMONIES AND TO SUBMIT TO THEM, EVEN AS A MATTER OF FORM, WOULD BE HYPOCRISY AND AN ATTEMPT TO DELUDE OURSELVES AND OTHERS.

WHEN I DIE, I SHOULD LIKE MY BODY TO BE CREMATED. IF I DIE IN A FOREIGN COUNTRY, MY BODY SHOULD BE CREMATED THERE AND MY ASHES SENT TO ALLAHABAD. A SMALL HANDFUL OF THESE ASHES SHOULD BE THROWN INTO THE GANGA AND THE MAJOR PORTION OF THEM DISPOSED OF IN THE MANNER INDICATED BELOW. NO PART OF THESE ASHES SHOULD BE RETAINED OR PRESERVED.

MY DESIRE TO HAVE A HANDFUL OF MY ASHES THROWN INTO THE GANGA AT ALLAHABAD HAS NO RELIGIOUS SIGNIFICANCE, SO FAR AS I AM CONCERNED. I HAVE NO RELIGIOUS SENTIMENT IN THE MATTER. I HAVE BEEN ATTACHED TO THE GANGA AND THE JUMNA RIVERS IN ALLAHABAD EVER SINCE MY CHILDHOOD AND, AS I HAVE GROWN OLDER, THIS ATTACHMENT HAS ALSO GROWN. I HAVE WATCHED THEIR VARYING MOODS AS THE SEASONS CHANGED, AND HAVE OFTEN THOUGHT OF THE HISTORY AND MYTH AND TRADITION AND SONG AND STORY THAT HAVE BECOME ATTACHED TO THEM THROUGH THE LONG AGES AND BECOME PART OF THEIR FLOWING WATERS.

THE GANGA, ESPECIALLY, IS THE RIVER OF INDIA, BELOVED OF HER PEOPLE, ROUND WHICH ARE INTERTWINED HER RACIAL MEMORIES, HER HOPES AND FEARS, HER SONGS OF TRIUMPH, HER VICTORIES AND HER DEFEATS. SHE HAS BEEN A SYMBOL OF INDIA'S AGE-LONG CULTURE AND CIVILIZATION, EVER-CHANGING, EVER-FLOWING, AND YET EVER THE SAME GANGA. SHE REMINDS ME OF THE SNOW-COVERED PEAKS AND THE DEEP VALLEYS OF THE HIMALAYAS, WHICH I HAVE LOVED SO MUCH, AND OF THE RICH AND VAST PLAINS BELOW, WHERE MY LIFE AND WORK HAVE BEEN CAST. SMILING AND DANCING IN THE MORNING SUNLIGHT, AND DARK AND GLOOMY AND FULL OF MYSTERY AS THE EVENING SHADOWS FALL, A NARROW, SLOW AND GRACEFUL STREAM IN WINTER, AND A VAST ROARING THING DURING THE MONSOON, BROAD-BOSOMED ALMOST AS THE SEA, AND WITH SOMETHING OF THE SEA'S POWER TO DESTROY, THE GANGA HAS BEEN TO ME A SYMBOL AND A MEMORY OF THE PAST OF INDIA, RUNNING INTO THE PRESENT AND FLOWING ON TO THE GREAT OCEAN OF THE FUTURE. AND THOUGH I HAVE DISCARDED MUCH OF PAST TRADITION AND CUSTOM, AND AM ANXIOUS THAT INDIA SHOULD RID HERSELF OF ALL SHACKLES THAT BIND AND CONSTRAIN HER AND DIVIDE HER PEOPLE, AND SUPPRESS VAST NUMBERS OF THEM AND PREVENT THE FREE DEVELOPMENT OF THE BODY AND THE SPIRIT; THOUGH I SEEK ALL THIS, YET I DO NOT WISH TO CUT MYSELF OFF FROM THE PAST COMPLETELY. I AM PROUD OF THAT GREAT INHERITANCE THAT HAS BEEN, AND IS OURS, AND I AM CONSCIOUS THAT I TOO, LIKE ALL OF US, AM A LINK IN THAT UNBROKEN CHAIN WHICH GOES BACK TO THE DAWN OF HISTORY IN THE IMMEMORIAL PAST OF INDIA. THAT CHAIN I WOULD NOT BREAK, FOR I TREASURE IT AND SEEK INSPIRATION FROM IT. AND AS WITNESS OF THIS DESIRE OF MINE AND AS MY LAST HOMAGE TO INDIA'S CULTURAL INHERITANCE, I AM MAKING THIS REQUEST THAT A HANDFUL OF MY ASHES BE THROWN INTO THE GANGA AT ALLAHABAD TO BE CARRIED TO THE GREAT OCEAN THAT WASHES INDIA'S SHORE.

THE MAJOR PORTION OF MY ASHES SHOULD, HOWEVER, BE DISPOSED OF OTHERWISE. I WANT THESE TO BE CARRIED HIGH INTO THE AIR IN AN AEROPLANE AND SCATTERED FROM THAT HEIGHT OVER THE FIELDS WHERE THE PEASANTS OF INDIA TOIL, SO THAT THEY MIGHT MINGLE WITH THE DUST AND SOIL OF INDIA AND BECOME AN INDISTINGUISHABLE PART OF INDIA.

EXTRACTS FROM THE WILL AND TESTAMENT
21ST JUNE, 1954

Jawaharlal Nehru

Jawaharlal Nehru's last will and testament (source : http://nehrumemorial.nic.in (http://nehrumemorial.nic.in))

Strong emotional attachments to the Ganges are still very much alive. I understood this in Benares, next to a woman from Mumbai, suddenly sobbing during an evening *Aarti* ceremony performed on the riverbank. She explained to me her deep attachment to the river and the extraordinary feeling that came to her during the ceremony. At a distance from the river, young Indian fellows repeatedly mentioned to me the warmth in their hearts when they heard the name Ganga. In those discussions, I was looking for the image that would arise in their minds when they heard the name of the river. However, it was not so much an image in the mind as a feeling within the body that they expressed.

Jawaharlal Nehru himself referred to his attachment to the river Ganges to justify his request. Interestingly, he expressly rooted this attachment in his childhood and in the Ganges-related “history and myth and tradition and song and story” (1956). In a similar way, a friend reported to me that her feelings towards Ganga could be phrased as a “feeling of connection”, a connection with her childhood as well as with the strong and long-lasting traditional reverence to the river, which gave her a sense of an immutable strength.

All this has elicited in me two ideas that I will develop in this theoretical essay. First, the reality of a river encompasses much more than flowing water – in particular emotions, attachment and symbols. In this regard, I will elaborate on a perspective that considers the meanings of “river-house” and “river-home”. Second, human–river relations should be considered through the concept of the *milieu*, as described by the French geo-philosopher Augustin Berque (2014). This approach emphasizes the deep entanglements of human beings and rivers. Some photos taken at various points during my field visits in India will alternate with these thoughts in order to illustrate them.

Nirmal *char*, Murshidabad district, West Bengal, India
(photo by the author)

RIVER-HOUSE AND RIVER-HOME

In American culture, as Daniel Ingersoll (1998) writes, the house/home distinction is important. “Americans learn the difference between house and home at an early age. House: a cold space enclosed by walls. Home: a warm place animated by family and friends” (Ingersoll, 1998 cited by Moberg, 2013, 277). Ingersoll further develops the notions in relating houses to the “profane realm of law and market economics, natural right, and profit” while relating homes to

“intangible wealth which can not be bought or sold”, as they “belong to the sacred world of fellowship, love and nurture” (1998, 6). He also opposes material (house) and social (home) artifacts, and finally observes that Americans “dwell simultaneously in physical houses and symbolic homes” (1998, 6).

This distinction is of great help to better explain diverging understandings of a given reality, like that of a river. The perspective on a river may be restricted to the water that flows, the sediments it carries or the aquatic species it shelters. Those components and their dynamics are what sciences (hydrology, hydro-geomorphology, ecology, etc.) study. They are also the resources economics deal with. Activities such as hydroelectricity production, irrigation, navigation, sand mining or fishing are the prism that economists use to look at rivers. Here, we could say that the word *river* only carries the meaning of “river-house”, referring to the “cold” realm of economics and materiality.

Maneri Bhali dam, Uttarkashi district, Uttarakhand, India (photo by the author)

However, rivers encompass symbols and human attachments too. The previous quotes about the Ganges illustrate this, but examples are not restricted to such a sacred river. In many instances, the literature reports human

feelings towards rivers. A French author, Michel-André Tracol, expresses for example his bitterness at the “dead” Rhône river, now tamed by embankments and dams, in contrast to the fascinating, fiery river that he and other “Rhodaniens” used to love (Tracol, 1980, 5-7). In social sciences, notably in Political Ecology, some authors have shown how much rivers are lived realities with emotions and interpretations attached to them that either reinforce or oppose dominant perspectives (Baviskar, 2005; Alley, 2002; Drew, 2017). In these texts, the word *river* obviously carries the meaning of “river-home”, or the “warm” realm of feelings and attachments.

In a conflict about hydropower in the upper Ganges, around the *Eco-Sensitive Zone of Gaumukh-Uttarkashi*, opponents and proponents of hydroelectricity express contradictory interpretations of what a river is. In the first group, the sacredness of the river is invoked and some people even consider the river to be “who we are” (field interview, 2016); for the latter, the river is a resource to be tapped for the sake of local and national economic development. The opposition between considerations of “river-house” and “river-home” here appears to be the origin of an intractable conflict.

Near the source of the Ganges (Bhagirathi stretch), Gaumukh, Uttarakhand, India (photo by the author)

THE *MILIEU*, OR THE EMPHASIS ON HUMAN–RIVER RELATIONS

As noted above, Ingersoll (1998) observes that the distinction between house and home does not prevent people from "dwell[ing] simultaneously" in houses and homes. People seem to "naturally" overcome the contradiction between the two perspectives. What about the distinction between "river-house" and "river-home"? One answer could be to move

beyond the question of what a river *is* (a “river-house” or a “river-home”). We may instead consider the human–river relationship that is present in both perspectives.

Science and economics are human interpretations of reality. Traditionally considered as purely rational, “cold”, or devoid of any emotions, science and knowledge production may sometimes be loaded with interests or even passion, as science studies has illustrated (notably the works of Callon & Latour). In addition, the frontier between object and subject has been blurred with the emergence of the Actor-Network theory. Hence, we argue that a distinction between “river-house” and “river-home” as an opposition between the “material” and the “social”, the “physical” and the “symbolic”, is not relevant. Both perspectives encounter physical, emotional and ideal human–river interactions; they both belong to the realm of a full human–river relationship.

Dehradun, Uttarakhand, India (photo by the author)

Geo-philosopher Berque provides interesting insights about such a human-environment relationship, or what he names the *milieu*. In his “mésologie”, he explains that the given environment, once interpreted (through senses, thoughts and actions) by a human society, is no longer an external thing. It becomes a *trajective* reality (an historicized construction, in a back-and-forth move), neither entirely objective, nor entirely subjective, i.e. the *milieu*, which incorporates the human dimension (Berque, 2014, 2016).

The *milieu* is thus simultaneously the given environment and the human interpretation of it. Material and social realms are here reconciled, as in the hydrosocial cycle framework developed within the political ecology of water (Linton & Budds, 2014).

Conversely, Berque argues that a human being is constituted by an "animal body" and a "medial body". The latter incorporates the "social body", which includes language for example, but also the *milieu* (with its historicity) itself (Berque, 2014). Thus, if one brings transformation to the *milieu* through any "eco-techno-symbolic processes" (Berque, 2016), such as physical interventions, this necessarily has consequences for human beings too.

In this perspective, the human–river relationship is a two-way, reciprocal one. This understanding of human–river relations goes beyond the incorporation of symbols, interpretations and attachments to rivers. It encompasses the agency of rivers, and the historicity of the relationship, and gives space for more human–river interactions than traditionally considered. In our view, this vision significantly renews the way one could assess the impacts of any river-related infrastructure or river valley transformation. For example, what and *who* change, if a river fish population decreases due to pollution or lack of fresh water?

Hamidpur *char*, Malda district, West Bengal, India (photo by the author)

CONCLUSION

In this essay, we have shown how the distinction between "river-house" and "river-home" helps to distinguish between two conceptions of a river: 1) a "cold" reality assessed by science or "market economics"; and 2) the recognition of the "sacred realm" of attachments and symbols related to it (Ingersoll, 1998). We have also demonstrated how Berque's concept of the *milieu* advances this understanding in bringing the reciprocal human–river relationship to the core of the analysis. Further empirical research could explore how the materiality of the river, in all its dimensions (water, sediments, biota, floodplains, etc.) precisely plays its role within the human–river relationship.

Nirmal *char*, Murshidabad district, West Bengal, India (photo by the author)

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APPENDIX 4: RESEARCH LOGFRAME

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Overall research question How do 'river meanings' and the materiality of a river interact and shape each other? Through what processes do 'river meanings' intervene in the governance of a river?				
Research question A *(addressed in Chapter Three and Conclusion)* How does Ganges 'rejuvenation' emerge as a problem to be addressed by public action?				
Sub-questions	*Information needed to reach objective / data categories*	*Methodology, sources of information and methods to access*	*Assumptions*	*Risks / alternative strategies*
A1. How has the Ganges been identified as an object of public intervention?	Primary sources: available grey literature related to Indian sectoral policies addressing river issues since Independence. For the paragraph on 'Historical interventions on river uses', use of secondary literature or available primary data	To answer this question, the research will propose a synthesis of some primary sources and of secondary literature. The approach will focus on central government's production of documents related to rivers and to the Ganges. Additional literature like grey and academic literature will be scrutinized according to - Snow-balling use of references,	The existing academic literature, notably Kelly Alley, 2002, did not miss important events related to the management of the Ganges during colonial times. The Planning Commission 5-year plans rightly reflect the priorities and problem statements from the	Risk of magnifying some problem statements at the expense of others. Strategy: use of secondary literature to check my interpretations

	(such as the *Arthashastra*). For additional insights and triangulation: Academic production related to Ganges policies and to river management in India, notably Gadgil and Guha on ecological and equity issues in India (1995), Kelly Alley about the Ganges (2002) and Ravi Baghel about river control in India (2016).	- Advice obtained from interviews of experts. Identification of the problem statements in the documents (in the introductory parts for example). From this starting point, and with the help of classical classification of river management sectors, the main categories and problem statements will be derived and classified. A synthetic narrative will then be derived (section 3.1). Triangulation to confirm the preliminary findings will be systematically practised (secondary literature, semi-structured interviews).	government of India, since independence.	

Sub-questions	*Information needed to reach objective / data categories*	*Methodology, sources of information and methods to access*	*Assumptions*	*Risks / alternative strategies*
A2. How has the Ganges 'problem' been made visible?	Grey literature produced in India on the Ganges pollution issues from 1960's onwards, by central authorities and public institutes (applied research or administrations). Use of reports produced by civil society, notably the Center for Science and Environment 's first 'State of the Indian Environment' published in 1986 for two purposes: - As a primary source, as it is a group of stakeholders' viewpoint and problem statements;	The approach will focus on the Ganges' pollution problem within the grey literature produced by the Indian authorities and related institutions, in order to capture the policy referentials (Muller, 2013). Additional literature like grey and academic literature will be scrutinized according to - Snow-balling use of references, - Advice obtained from interviews of experts. A narrative will be derived from the confirmations (saturation) obtained from secondary literature and interviews of experts (I qualify as experts some stakeholders or scholars, generally retired, who have spent	The main assumption here is that it is doable to capture Ganges' politicizations during previous decades through historical written sources or grey literature.	Risk of wrong generalization from de-contextualized written sources. Strategy: Contextualization of sources and triangulation through secondary literature and interviews with informed experts and scholars should avoid larger mistakes. In addition to scholars and experts identified by myself, further suggestions to be collected from Dr. Jenia Mukherjee, IDSK/IIT Kharapgur and Dr.

	- as a secondary source to provide data on the pollution issue and on the reactions it triggered. Use of academic literature as secondary sources, notably Alley, 2002; Jaffrelot, 1993 ('The Hindu nationalists', an authoritative study of the Hindu nationalist movements from the 1920's to 1990's).	most of their career observing and reflecting on water issues in India). See section 3.2.		Audrey Richard, French Institute of Pondicherry.

Sub-questions	*Information needed to reach objective / data categories*	*Methodology, sources of information and methods to access*	*Assumptions*	*Risks / alternative strategies*
A3. In this historical and gradual process of political and ecological redefinitions of the river, what 'river meanings' are politicized, what 'river meanings' remain unaddressed?	Discourses related to the Namami Ganges programme and explicit expressions framing the 'Ganges' problem' from Central government's actors. Discourses on these discourses from engaged non-state actors. The first set of discourses will be collected from various contemporary sources: official press releases or responses to questions in the Parliament -*Lokh Sabha*) (often published by the Press Information Bureau);	To address this question, the approach will consist in describing and analysing the *Namami Gange programme* as the most recent expression by the Central authorities of the 'Ganges' problem'. The analysis will replace this policy tool in the trajectory of the previous policy referentials (studied in sections 3.1 and 3.2) to show the continuities as well as the disruptions (see section 3.3). The framework of a policy referential analysis (Muller, 2013) will be mobilized. Secondary literature will be used to guide the patterning of the discourses, if relevant (for	The main assumption here is that the *Namami Gange Programme* is not merely a communication product from the Government of India but a real policy tool that reflects an understanding of a 'Ganges 'problem' -and not only a political/partisan short-term strategy. This assumption does not depend only on the 'sincerity' of the government of India but also on the reactions and future actions triggered by this programme, among state and non-state actors.	Risk of a wrong assessment of the significance of the *Namami Gange programme* on the long-term, because of a lack of temporal distance with the case. Strategy: this would require a follow-up of the topic that would extend beyond the timeframe of this doctoral work. As an alternative strategy, the responses to the research question are presented as qualitative comments in the conclusion, and not as proper research findings.

	official websites (ministries, authorities); Anglophone press reports. Official images in the press or on official websites as well as Youtube videos posted by government-affiliated agencies will be studied too. Participant observation in seminars and official events will be conducted too. Finally, interviews with some officials will be also conducted. The second set of discourses will be	instance, Baghel, 2016, Sharma, 2005 or Jaffrelot, 1993). The *Gaumukh-Uttarkashi Eco-Sensitive Zone* case study will also be mobilized to further guide the analysis, as the politicization of the river is a focus point of the ECZ analysis. Finally, further inputs from the Gaumukh-Uttarkashi and the Ganges Lower Basin case studies will help to draw qualitative comments to answer this question in the main conclusion.		Risk of lack of objectivity as I may be indirectly concerned through my consultancy work for EU-India Water Partnership. Strategy: using the spatial distance (India-Switzerland) to reflect on these issues, alternating "engaging with" and "stepping back" phases.

	collected from grey, academic and activist literature, media reports and blogs. Participant observation will be conducted in events organised by some of the engaged organisations (mainly environmentalist ones). Interviews with some key figures of these non-state movements and organisations will be conducted too. Some State representatives will be interviewed too, according to the opportunities open by the field research for the two case studies.			

	Grey literature and administrative reports related to *Namami Gange programme* will also be consulted to elaborate the description of the programme.			

Research question B *(addressed in Chapters Four, Five, Six and Conclusion)* How to mobilize and further define the hydrosocial approach in river contexts?				
Sub-questions	*Information needed to reach objective / data categories / sources of information and methods to access*	*Methodology*	*Assumptions*	*Risks / alternative strategies*

B1. How does the materiality of a river -that is not restricted to water flows- intervene in the hydrosocial cycle?	Data and analysis of the sediment-related phenomena in the Lower Ganges Basin, drawn from academic literature in physical geography, hydrology, hydromorphology, sedimentology and ecology. Grey literature, notably administrative reports, authorities' annual reports, etc. about erosion issues, disaster management and sediment management policy. Data collected from Environmental history research (conducted by Dr. Jenia Mukherjee	To answer this question, the approach will consist in zooming in the Ganges lower basin and to focus on sediment issues, as a proxy of the river's materiality and its heterogeneity. The analysis aims to capture past and present moments of the hydrosocial cycle that incorporates sediment within the river-society relations. The case studies will be nested in temporal and spatial scale from large to small: the general environmental history of the Lower Ganges basin, the Farakka barrage construction event and its consequences, and Hamidpur char that is located about 11km upstream of Farakka barrage.	Following the *Political Ecology of Water* and *hydrosocial cycle* theoretical frameworks, the assumption here is that the materiality of water shapes and is shaped by the social order in an internal and dialectical relation (Linton and Budds, 2014). The analysis aims to account for these reciprocal links.	Risk of misunderstanding causalities in a complex setting. Strategy: investigating factors rather than causalities and nuancing causal explanations. Following the call of Critical Physical Geography (Lave et al., 2014), use of specialist secondary literature, notably in physical geography, to avoid simplified representations of physical phenomena. Difficulty to get official agreement for recorded interviews.

	over the years 2010-2017), notably on Bengal's colonial archives, on the field in Murshidabad and Malda districts and in secondary literature (Lahiri-Dutt and Samanta, 2013; D'Souza, 2006 notably). Interviews with administrative and local actors at the District, Block and Gram Panchayat levels, during field visits.	The hydrosocial moments will be captured in the case narratives through the study of the role of frames of thought in the governing paradigms and of how local residents, as well as authorities, adjust and react to the land-water 'moving terrains' (chars). Physical processes around sediment will be incorporated through qualitative descriptions. Triangulation will be made with further interviews of distant people (for instance, State level representatives) as well as with secondary literature.		Strategy: collecting visions and commentaries out of the record, with only taking notes on papers, to give the priority at building a confident relationship.

Sub-questions	*Information needed to reach objective / data categories / sources of information and methods to access*	*Methodology*	*Assumptions*	*Risks / alternative strategies*
B2. How do emotional and symbolic attachments towards a river intervene in the hydrosocial cycle?	Discourses related to the Eco-Sensitive Zone conflict produced by insider and outsider actors, with explicit or implicit mentions of 'Ganges river meanings'. The discourses will be collected from various supports: archives, reports, online materials and interviews. In particular, written documents will be comprised of administrative	To answer this question, the approach will consist in studying the politicizations of the River Ganges in the context of the Gaumukh-Uttarkashi Eco-Sensitive Zone (ESZ) struggle, in the Himalaya (Uttarkashi district, Uttarakhand). The studies aims to scrutinize in what context, how and with what effects the sacred dimension of the River Ganges has intervened in the ESZ political decision. In this regard, the approach is qualitative and follows two objectives: 1. to retrace the history and developments of the	The main assumption here relies on the policy referential framework developed by Pierre Muller (2013). In substance, I assume that the policy referential related to the ESZ, and the river meanings attached to it, are predominantly produced by the authorities and a small community of key figures and stakeholders, who have a certain access to the political authorities (i.e. the 'policy community' in the sense of Muller, 2013). In this regard, an ethnological approach of the case will not	Risk of low access to information due to geopolitical tense situation (India-China border area) and heated topics (for example contested hydroelectricity). Strategy: communicating with intermediaries in Dehradun or Delhi. Risk of unbalanced weight attributed to certain figures and their perspectives in the conflict.

	documents, publications, grey literature, affidavits, tribunal decisions and press communiqués. Use of an extensive Anglophone press review, and of semi-directed interviews with some key players in Delhi, Dehradun, and in the Bhagirathi valley, in order to classify and prioritize these discourses, as well as for triangulation. Field visits will also help to understand the context, as well as secondary literature, notably Rangan, 2000 for an historical account	ESZ decision; 2. to decipher the leading meanings of the river within actors' discourses. The investigation focuses on the political process that led to the decision and that followed it. Therefore, the targeted actors are not residents, nor local stakeholders such as farmers, industrialists, tourists or pilgrims. They are neither global nor international ones. They belong rather to the 'policy community', which is involved in formulating the 'referential frame' of the ESZ-related policy (Muller, 2013). Semi-structured interviews with main figures of the observed mobilizations (Delhi, Dehradun or more locally). These "figures" will be selected according to a 1-	be required to answer our research question.	Strategy: developing interviews and discussions with external experts for them to share their own analysis and comments. Selecting one angle in the analysis, even somehow schematic (for example, a duo of conflicting perspectives) and not pretending for completeness.

	of Uttarakhand State, and the Georgina Drew's recent ethnographic investigation of the ESZ conflict, from an 'everyday religious practice and belief' and gendered perspective (Drew, 2017).	year press review on Ganges issues (use of a Google alert with the terms "Ganga" and "Ganges") and the persons' willingness to be interviewed. Then use of snow-ball approach to identify further interviewees, or to identify key information resources.		

Sub-questions	*Information needed to reach objective / data categories / sources of information and methods to access*	*Methodology*	*Assumptions*	*Risks / alternative strategies*
B3. How to further define the nature, roles and politics of 'river meanings' in the hydrosocial cycle framework?	Non applicable (NA)	This question requires a theoretical reflection drawn from the work developed in each of the chapter of this doctoral work. The conclusion will address this question.	NA	NA

APPENDIX 5: LIST OF INTERVIEWS

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	Interview date	Place	Interviewee	Main topics	Interaction type
1	20151123	Delhi	National Water Mission Director, Ministry of Water Resources, Rivers development and Ganga rejuvenation	Draft Indian Water Framework Law, Ganga rejuvenation	Interaction
2	20151123	Delhi	Former National Mission Clean Ganga Director, Ministry of Environment and Forests	National Clean Ganga Mission, States' roles, Eco-Sensitive Zones	Interaction
3	20151123	Delhi	Environment Counsellor, European Delegation in India	Indian water framework, draft Indian Water Framework Law, Indian-EU cooperation in water sector	Interaction
4	20151123	Delhi	Chief Executive, ETI Dynamics	Ganga rejuvenation, National Clean Ganga Mission, Public Private Partnership for sewage projects	Interaction
5	20151124	Delhi	Director Rivers, World Wildlife Fund, India	River issues in India, Draft Indian Water Framework Law	Interaction
6	20151126	Delhi	Director Rivers, World Wildlife Fund, India	River management in India, data gaps in water sector, stakeholder engagement	Semi-structured interview
7	20151126	Delhi	Director, Yamuna Jiye Abhuvan	Rivers Day event co-organised by INTACH and WWF on 28 November 2015	Interaction
8	20151127	Delhi	Indian Police Service Offier, Indo-Tibetan Border Force	Gnaga's yatra by Minister of Water Resources, Rivers development and Ganga rejuvenation, Namami Ganga Programme, communities awareness	Interaction
9	20151128	Delhi	Chief Engineer, Central Water Commission	Draft Indian Framework Law, administrative settings of Indian water management	Semi-structured interview
10	20151201	Delhi	Director Eco-Sensitive Zones, Ministry of Environment and Forests	Eco-sensitive zones' procedures, Gaumukh-Uttarkashi Eco-sensitive zone	Semi-structured interview
11	20151201	Delhi	Ganga Programme Project Director, World Bank	Namami Ganga programme, World Bank's programme to support Ganga rejuvenation	Semi-structured interview
12	20160711	Delhi	Ganga Programme Project Director, World Bank	Namami Ganga programme, World Bank's programme to support Ganga rejuvenation	Interaction
13	20160712	Delhi	Coordinator, South Asia Network on Dams, Rivers and People	Namami Ganga programme, Gaumukh-Uttarkashi Eco-Sensitive Zone, river governance in India, ethics	Semi-structured interview
14	20160714	Dehradoon	President, Rural Litigation and Entitlement Kendra	Gaumukh-Uttarkashi Eco-Sensitive Zone struggle, dams in Uttarakhand, ethics	Semi-structured interview
15	20160714	Dehradoon	Former Tehri resident	Tehri dam conflict and people rellocation	Interaction
16	20160714	Dehradoon	Vice-Chancellor, Doon University	Ganga rejuvenation, water management in India	Interaction
17	20160714	Dehradoon	Register, Doon University	Uttarakhand State projects in the water sector, Institute of Ecology and Geology, Dehradoon	Interaction
18	20160716	Dehradoon	Former Director, People Science Institute	Gaumukh-Uttarkashi Eco-Sensitive Zone struggle, dams in Uttarakhand	Semi-structured interview
19	20160717	Dehradoon	Former Director, People Science Institute	Gaumukh-Uttarkashi Eco-Sensitive Zone struggl, Namami Gange Programme, ethics	Semi-structured interview
20	20160718	Dehradoon	Member, Ganga Aahvan forum	Gaumukh-Uttarkashi Eco-Sensitive Zone struggle, key actors	Interaction (on the phone)

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21	20160720	Dehradoon	Former Chief Secretary, Uttarakhand State	Gaumukh-Uttarkashi Eco-Sensitive Zone struggle, Uttarakhand State's roles and perspectives	Semi-structured interview
22	20160829	Delhi	Former National Water Mission Director, Ministry of Water Resources, Rivers development and Ganga rejuvenation	National Water Mission, Namami Gange programme	Semi-structured interview
23	20160902	Delhi	Former Secretary, Ministry of Water Resources	River management in India, river governance, water conflicts, Ganga policies	Semi-structured interview
24	20160902	Delhi	Professor of Anthropology, Jawaharlal Nehru University	Cultural approaches of water in India	Interaction
25	20160904	Dehradoon	Former Director, People Science Institute	Gaumukh-Uttarkashi Eco-Sensitive Zone struggle, relations between State and Central governments	Interaction
26	20160908	Uttarkashi	District Magistrate, Uttarkashi district	District development issues, Gaumukh-Uttarkashi Eco-Sensitive Zone process. Clean Ganga Mission	Semi-structured interview
27	20160909	Bhagirati valley	Member, Ganga Aahvan forum	Gaumukh-Uttarkashi Eco-Sensitive Zone struggle, Namami Gange programme, valley development issues	Semi-structured interview
28	20160910	Bhagirati valley	Bijwassa vendors	Gaumukh-Uttarkashi Eco-Sensitive Zone struggle, valley development issues	Interaction
29	20160910	Bhagirati valley	Pilgrims	Attachment to river Ganges, pilgrimages	Interaction
30	20160910	Bhagirati valley	Religious figure	Attachment to river Ganges	Interaction
31	20160911	Gangotri	Forest department staff	Bhagirathi valley development issues	Interaction
32	20160911	Gangotri	Religious figure	Himalayas development issues, Gaumukh-Uttarkashi Eco-Sensitive Zone struggle. Clean Ganga Mission	Interaction
33	20160912	Bhagirathi valley	Former Tehri residents	Tehri dam displacement processes	Interaction
34	20160912	Bhagirathi valley	Alaknanda valley and Uttarkashi district residents	Himalayan development issues	Interaction
35	20160915	Delhi	Team leader Strategic Basin Planning for Ganga River project, World Bank	River Ganga planning, modelling, Ganga knowledge center	Interaction
36	20160915	Delhi	Officer, Uttar Pradesh Irrigation Department	Water conservation, Ganga canals and agricultural practices	Interaction
37	20160916	Delhi	Experts at EU-India workshop on environmental flows	Environmental flows	Interaction
38	20170202	Kolkata	Chairman, ENDEV	Sunderbans environmental and development challenges, Environmental State of West Bengal	Semi-structured interview
39	20170203	Kolkata	Historian, Jadavpur University	Sunderbans cultural traditions, human-nature relations	Interaction
40	20170204	Eastern Kolkata Wetlands	State fisheries staff, residents	Fisheries activities, development issues, water management	Interaction
41	20170208	Murshidabad	Additional district magistrate, Murshidabad district	District development issues	Semi-structured interview
42	20170208	Murshidabad	Head, Planning and GIS unit, Murshidabad district administration	Flood maping issues, development and social issues in the Murshidabad district	Interaction

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43	20170209	Bhagwangola II block	District Block Officer, Bhagwangola II	Nirmal char development issues, disaster management	Semi-structured interview
44	20170209	Bhagwangola II block	Nirmal char residents, school teacher, Gram Panchayat members	Flodd and erosion issues, disaster management, development issues	Interaction
45	20170210	Kolkata	Consulate of France	West Bengal politics, relations with Central government	Semi-structured interview
46	20170214	Kharagpur	Sanskrit professor, IIT Kharagpur	River words in sanskrit, meanings and related traditional river uses	Interaction
47	20170915	Kharagpur	Geology and geophysics environmental science professor, IIT Kharagpur	Hydrogeological processes in Lower Ganges basin	Interaction
48	20170917	24-Parganas district	District Magistrate, 24-Parganas district	24-Parganas development and social issues, Ganga policies, West Bengal policies	Semi-structured interview
49	20170218	Kakdwip division headquarter	Gram Panchayat member, Trinamool Congress party worker, 24-Parganas district	Development policies from West Bengal State, local context	Interaction
50	20170218	Namkhana island	Residents	Migration issues, development and access to water, flood and erosion issues	Interaction
51	20170219	Sagar island	Residents, inter-island travelers, Block development office	Migration issues, development opportunities, erosion issues	Interaction
52	20170220	Kolkata	Professor and researcher, Indian Institute of Management, Kolkata	Ganga policies, water governance issues in India, ecosystem services approach	Semi-structured interview
53	20170221	Kolkata	Head, State Pollution Control Board, West Bengal	Water, sediment and land issues in West Bengal, Ganga policies, Namami Gange programme	Semi-structured interview
54	20170221	Kolkata	Program Lead, Climate change adaptation, World Wildlife Fund, West Bengal	Lower Ganges basin, communities, water issues and livelihoods	Semi-structured interview
55	20170715	Delhi	Delhi resident, Ganga devotee and astrologist	Feelings and practices of reverence to the Ganges	Semi-structured interview
56	20170716	Delhi	Political science professor, Ashoka University	Links between Indian administration and politics, Hindu nationalism	Interaction
57	20170719	Kharagpur	Professor in Environmental economics, IIT Kharapgur	Ganga River Basin Management Plan processes	Semi-structured interview
58	20170719	Kharagpur	Professor, Chairman of the School for Water Resources, IIT Kharapgur	Ganga River Basin Management Plan elaboration and findings	Semi-structured interview
59	20170719	Kharagpur	Professor in Industrial economics, IIT Kharapgur	Ganga River Basin Management Plan elaboration and findings	Semi-structured interview
60	20170719	Kharagpur	Professor, Hydrology, IIT Kharapgur	Hydrological data on the Ganges river, river management, Farraka barrage, Ganga River Basin Management Plan elaboration and findings	Semi-structured interview
61	20170721	Kaliachak II	Block Development Officer, Kaliachak II	Erosion phenomena, disaster management, communities and livelihoods, block and district's roles, Farraka barrage authorties	Semi-structured interview
62	20170721	Kaliachak II	Hamidpur Gram Panchayat assistant	Erosion, disaster management, communities and livelihoods	Interaction
63	20170721	Hamidpur Char	Gram Panchayat member, residents	Erosion, village development issues, local governance, disaster management	Interaction

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64	20170721	Malda	District Magistrate, Malda district	Nirmal Bangla, Namami Gange programme, sanitation	Semi-structured interview
65	20170722	Kharagpur	Doctoral student, IIT Kharagpur	Agricultural practices in West Bengal, types of soils	Interaction
66	20171023	Kharagpur	Participants and other speakers at Short Term course on 'Combining hydrology and hydrosocial: towards comprehensive understanding of riverine systems' for All India Council for Technical Education - Quality Improvement Programme (23-29 October 2017)	Hydrosocial cycle in the Indian context, hydrocultural frameworks	Interaction
67	20171030	Belda	Students in Geography (50), Belda College, Vadyasagar University	Environmental policies towards rivers and towards the Ganges, human-river relation	Interaction, questionnaire