

An ontology of water and land in North Bihar, India[★]

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The floodplain of the Himalayas is a land formed and destroyed incessantly by the water of its rivers. Measures intended for flood control, aimed at separating productive land from river water through earth levees, have instead worsened the inundations, disrupting the beneficial flow of soil through floodwaters, obstructing water drainage, and resulting in enormous waterlogged areas. This article proposes that the failure of flood control in Bihar, India, is due to misunderstanding the river as a matter of water only, hence attempting the conceptual naturalization of an otherwise relative ontological distinction between water and land. Local knowledge of water reveals that neither water nor land can even be named, let alone understood, without the other. Informed by ethnographic fieldwork and multidisciplinary research in North Bihar, this article presents land and water as being in intimate correspondence with each other. By virtue of comparison, the ethnographic encounter is held to defy other ontologies of water that see the two substances as being in opposition. As a result, this article posits ontologies of natural substances as 'watertight', sclerotic, mutually exclusive, unable to adapt, and prone to be caught in a semiotic conflict.

North Bihar, India, is a land incessantly built and wrecked by its dense interlacing of waters. Sediments released by the rivers that flow from the Himalayas gradually construct the geology of the floodplains. As they create the landscape, the rivers continuously erode the soil of their own banks and cyclically avulse, or shift, their beds. While floods have long been a seasonal way of life in the Gangetic plains (Hill 1997; Lahiri-Dutt & Samanta 2013; Mishra 2001), they have become far more frequent and disastrous in North Bihar over the last three to four decades, following the construction of embankments that have modified the fluvial ecology (Mishra 1997; 2012a). Along most of these rivers, embankments have been built, cutting the landscape into two, seemingly separating water from land but eventually re-joining them in a myriad of unexpected and undesired conglomerates.

North Bihar, a place where water and land fundamentally constitute each other, poses questions regarding the ontology of water, defined both through its landscape and by

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its people.¹ This article, an ethnography of ‘kinding’ (Kockelman 2010) or ‘worlding’ (Descola 2014), argues that, in this context, an ontology that separates water and land becomes strained, both physically and conceptually. Studying North Bihar helps us to question a way of understanding land and water as absolutely separate from the other, and instead posits them as ontologically intimate, not only in a continuum of mixtures between the two, but as two sides of the same coin.

Not everybody, however, *words the world* in the same way. Not everybody shares such an ontological set of suppositions, and therefore belongs to the same community of practice or, as I call it, the same ‘ontological community’. When in a conversation, speakers from different ontological communities may face a semiotic conflict if they are unable to relativize their ontologies. During my fieldwork in North Bihar, I serendipitously realized I was facing such a situation: when pointing at the same substance and calling it by the same name, my interlocutors and I were not necessarily meaning the same thing. To explain the disjuncture between the technology and the local understanding of water, as well as my own, I propose the notion of semiotic conflict, a minor concept mostly used in didactics to justify students’ misunderstandings (Blanco, Godino & Pegito 2012; Burgos & Godino 2020; Mayén, Batanero & Díaz 2009). A semiotic conflict is a divergence of interpretation that leads to interrupted or problematic encounters, including in relation to technological intervention, development projects, and ethnographic conversations. Semiotic conflicts, I posit, are very common, because it is particularly difficult to relativize the semantics of natural matters, which I posit as *sclerotic* categories, rigid and unable to adapt.

Ontology is a concept with shifting meanings. Here I define it as the contingent way through which people consider the things that exist in the world as separate entities, therefore identify and classify things, while taking into consideration their interconnected materialities and meanings. An ontology explains what something is, what it is for, what it means (Descola 2013). It is a subset of culture (Venkatesan, Carrithers, Canda, Sykes & Holbraad 2010) – with the caveat that culture cannot be subsumed under such a narrow definition of ontology. While ‘worldview’ may not be the appropriate term, the simpler ‘locally shared categories’ may substitute for my use of ontology here, as will become clearer towards the end of the article. Where a linguist may approach this matter with more attention to the taxonomy and lexicon, I take guidance from the embedded and embodied dictionary that people use, which is revealing of their pragmatic ontology.

Discussing ontology in these terms matters because it illuminates the ways in which we know our world, and therefore how we communicate our knowledge of it. In fact, my definition of ontology is more related to epistemology than to metaphysics (instead suggested by Kohn 2015). If ontology is a way of dividing up the world (Descola 2013), then epistemology (or, more precisely, gnoseology) is the way in which features of the world are perceived and systematized according to ontological distinctions.

If, speaking of ontology, the recent ‘ontological turn’ at the hands of post-humanist Amazonian scholars (Kohn 2015; Viveiros de Castro 2012; but also Blaser 2014 and others cited later in the text)² comes to mind, it is fruitful to recognize immediately that this article rests instead on the shoulders of earlier studies of locally shared conceptualizations of things, studies that have long called into question the absoluteness of our ontologies. Anthropological scholarship pre-dating the ‘ontological turn’ has revealed how different things can be thought of through relative and contingent

meanings: for example, studies of the colours of water (Boas 1881; 1938) and the significance of cattle (Evans-Pritchard 1940), as well as ethnobotanics (Conklin 1955) and the political ecologies of mosquitoes (Mitchell 2002). This article does not engage with notions of the subjective personhood of nonhumans (Descola 2014), or how nonhumans think (Kohn 2013), or think of themselves (Viveiros de Castro 2012). While agreeing with the ‘ontologists’ that things are concepts (Henare, Holbraad & Wastell 2007) in the division of opinion created by the ontological turn, I stand with Astuti (2017) and Graeber (2015) in saying that ‘the greatest achievements of anthropology have come when we are willing to . . . put apparently exotic concepts to work to reexamine our own everyday assumptions’ (Graeber 2015: 6). In the present case, the ‘radical alterity’ of the inhabitants of North Bihar sheds new light on the familiar categories of water and land.

No one has expressed the way in which we distinguish things as clearly as Putnam in ‘The meaning of “meaning”’ (Putnam 1975). In this seminal essay, Putnam, combining both indexicality and sociolinguistic practices, announces that, in the mind, there are no meanings, but only stereotypes, by which he means standardized descriptions. He does so by imagining the inhabitants of Twin-Earth, which is a planet just like Earth, but where the word ‘water’ is used to refer to a liquid that, despite appearing like water, is not H₂O. In so doing, Putnam theorizes how communication and interaction are contingent not only on a theory of truth, but also on the way in which the agents involved relate to the things in the world.

By showing how water and land are generally assumed to be separate yet how they occur together in some people’s worldviews, this article can be considered a cautionary tale about semiotic conflicts. Just like Putnam’s Twin-Earth, North Bihar, the place of rivers and floods, makes us sensitive to multiple understandings of land and water. If one wants to avoid misunderstandings in communication and knowledge negotiation, for example those that occur in development encounters or technological interventions, one needs to be ready to question one’s own ontology, thus screen for assumptions of universalism, the categories, and the words used. Theorizing ontological differences at the origin of conflicts also opens up possibilities for their resolution.

I present this argument in three parts. First, based on studies of science and technology as well as on over five years of participant observation in North Bihar, I discuss how the *theory* behind embankments is grounded in the assumption that water and land are two separate substances, even as the *materiality*³ of the embankment in North Bihar manifestly shows that land and water are instead intimately related. On this basis, I argue that the ontology embedded in the theory of the embankment is at odds with the specific context of North Bihar itself, and this ‘bad fit’ transforms the intended separation of water and land into multiple dangerous entanglements. In the second part of this article, I use examples from my fieldwork to narrate how the rural inhabitants of the floodplains deal with both water and land in practices and narratives that demonstrate the cognitive as well as material intimacy of the two elements. The third part of the article aims to further expand the consequences of this specific ontology when in conversation with others with more common ways of categorizing water. This last part also expands on ideas of semiotic conflict, a mismatch in interpretations of a sign by speakers of different communities of practice, of different ‘ontological communities’.

All ethnographic data were collected during my fieldwork in North Bihar (in the districts of Saharsa, Supaul, Khagaria, Madhubani, East Champaran, West Champaran,

as well as Dharbanga, Samastipur, Muzaffarpur, Araria, and Sitamarhi) from 2007 to 2008, when I experienced floods first-hand, as well as from early 2012 until late 2015, and in visits all lasting several months in 2009, 2010, 2011, 2017, and 2019. Based on this prolonged fieldwork in the area inside the river embankments or just outside it, I here argue about an ontology widespread amongst the diverse inhabitants of this flood-affected region, my interlocutors being representative of the area in terms of gender, age, religion, class, and caste. My ethnographic examples stem from multiple interactions instead of the narration of singular specific encounters. The only exception is Shree Ramji Poddar – Poddar Babaji as I call him – a mentor and a close friend, born in 1920 or 1921, whose wisdom and wit pepper this article.

The ontology of the embankment

In theory

In Bihar, the technology of embankment, which claims to contain the river from spilling over productive land yet re-creates entanglements of watery soil and soily waters, is in tension with the local ontology of such substances.

An embankment is a wall of soil that is meant to contain the water of a river. There are so-called ‘natural’ embankments, erected by the river through the accumulation of its sediments and continuously modified by the flow of water. The embankments built along the rivers of North Bihar in the last century, in contrast, have been engineered in the landscape by human activity. Humans have built embankments, with mixed outcomes, for millennia.⁴ It is beyond the scope of this article, however, to make a historical or political reading of how these embankments came to be imposed in this particular landscape, apart from noting that the main goal of their construction was to reduce flooding.⁵ Instead, I will discuss here first the embedded assumptions that accompanied their design, and then the unintended mix of water and soil that results from their construction. Embanking a river was supposed not only to barricade inhabited or cultivated land from rising flood waters, but also to modify the river such that it would self-contain its rising waters. The hydrological assumption was that confining the stream would increase its velocity. The faster the current, the more sediments the river would then scour from its own bed. The resulting degraded or ‘dredged’ river would sink in and become incised, thus – it was assumed – it would accommodate more water and have a lower probability of bursting its banks.

Although Gregory (2001) locates the beginning of the discourse of hydrology and hydraulic engineering, which translates ‘nature’ into mathematical formulae, to the end of the nineteenth century, their origin can be plausibly found in the writings of the seventeenth-century mathematician who first investigated the physics of river flow, the Italian hydrologist Guglielmini. It was he who proposed a mathematical relationship between key morphological characteristics of the river, such as depth, width, and velocity (Barry 1997; Guglielmini 1697). Modifying one of these parameters was seen as instrumental in eliciting changes in the other variables.

The application of Guglielmini’s mathematical formula to embankments was probably the result of a misunderstanding. There are three aspects to this misunderstanding. First, Guglielmini’s description and representation of a river are actually closer to those of a canal: his descriptions of a river are those of a channel where boundaries between water and land are neatly defined; where water starts when the soil finishes and vice versa; where each substance is confined by the other. This sounds quite distinct from any river, and in particular tropical rivers (Lahiri-Dutt 2015), and much

closer to the modern canal, 'simplified, abstracted Water, rigidly separated from the earth and firmly directed to raise food, fill pipes, and make money' (Worster 1985: 5; see also Latour 1998).⁶ Second, the formula was meant to be context-independent, but was then implemented in building embankments on rivers with variable morphological characteristics that cannot be decontextualized. Third, Guglielmini's mathematical abstraction was based on a cross-section of the river under ideal conditions, and yet considered representative of the whole river.

A river conceptualized as a canal is far from accurately represented. The complexity of an actual river, inserted into a complex geography that includes the ecologies of land and water, comprises different morphological characteristics in the same stream, uneven gradients, and a fluctuating sediment load. Those variables elude the representational capacity of the equation, based as it is on assumptions of isomorphism. When considering embankments, the larger ecology is to be considered: an intermingling of streams, aquifers, marshes, lakes, ponds, rocks and soils, organic matter, and living creatures. Any model of fluvial ecology, as well as any infrastructure that serves to manipulate it, will always be more dynamic in reality than on paper, particularly if we consider the temporal disjunction between an embankment's design and its realization.

These realities were overlooked in the ontological distinction at the origin of the simplistic concept of embankment. Such a distinction – far from an isolated distortion – recalls several paradigmatic topoi in the conception of nature, similarly based on a separation of land from water. One is the master trope of the walled city (Fustel de Coulanges 1874), where a wall's purpose is to deter enemies and protect what lies within.⁷ The outlaw in the case of the embankment is untameable nature – or, more specifically, water – perilous for land, dangerous to civilization. Another common trope, studied by psychoanalysts, is that of slime, a disturbance of the divide between the two physical states of solid and liquid, a trespassing of dirt into an ideal pure fluid, often met with distaste or even revulsion. Giblett (2013) talks about the cultural abjectness of smelly and formless slime, and its cross-cultural associations with women, vaginal fluids, and death.⁸ A third trope, very common in contemporary studies of water, is the heuristic separation of water from other processes and substances. This separation is found even in the work of anthropologists and human geographers – an example being the contemporary concept of the hydrosocial cycle (Linton & Budds 2014). While usefully introducing society within the naturalistic representation of water, the hydrosocial cycle concept chooses to ignore other ecological processes and nonhuman interactions in wet environments, and therefore essentializes water as H₂O (Camargo & Cortesi 2019).

These cultural constructions originate from an ontology that first separates water from soil, liquid from solid, nature from culture, and then connects these dichotomous pairs in chains that co-ordinate our worldviews. Metaphysically, the embankment is therefore the solid soil protecting land against the liquid, rebellious nature of water. As I shall discuss, this point of view is detectable not only in seventeenth-century hydrology treatises; it has materialized into thousands of kilometres of embankments along all the main tributaries of the Ganges, whose construction was initiated during India's independence (Mishra 2002) and is still going on today.

In practice

Bihar, the land of rivers, is also the land of embankments: unofficial figures give 5,000 kilometres of them, and counting. To account for this reality, I now move from

embankment theory, or the theoretical assumptions inherent in the technology of the embankment discussed above, to what happens in practice once the embankments are constructed, the embankments' material enactment.

When embankments were constructed, local inhabitants protested, and still do. Most of the answers to my embankment-related questions over years of fieldwork reveal the diffused discontent and disappointment with the embankments and their causal repercussion in the landscape and on sociality. Rarely did I find places where people had not experienced floods that they related as caused or worsened by the embankment. The embankment, many people in North Bihar have explained to me, is an attempt 'to tie the water'. *Banhal pani* – a local variation of the more common *bandhal pani* – means 'tied or controlled water, water whose flow is impeded', the opposite of *citraya pani*, 'spreading water'. The embankment is defined as the means to obtain control over water. 'Isn't it good to control floods?', I often asked. While I found a variety of replies over the years, such a provocation is often laughed at. The compelling history of embankment failures is evoked to explain. The embankment's appearance of control is indeed only chimerical, many people say, an illusion: it fails more often than not, and the failure of control results in disastrous overflows of water across the land. The embankment works while it works, after which things are worse than before, some, often young men, specify. Others, more experienced men and women, are even more sceptical: it never works, its effects are always negative, they say. 'He is a fool who thinks to tie the water with land', as Poddar Babaji puts it for me.

What happens when this ontological division between solid land and liquid water materializes in the landscape of North Bihar? As the people of the area explain, embanking the peculiar morphology of these Himalayan rivers has had a multiplicity of dangerous ecological and hydrological consequences. Though the purpose was to keep the land outside the river dry and protected from floods, the result has been anything but a separation of land and water.

First, instead of degrading (as expected), the riverbed of these sediment-loaded rivers aggraded. With the levees trapping sediments, obstructing their release, the riverbed grew higher than the countryside, which necessitated the construction of ever-higher embankments. To prevent backflow and allow for stream confluence, once one part of the river was embanked, the entire length of the river, including its tributaries, had to be embanked as well. In this new, menacing morphological configuration of built-up embanked rivers towering above the countryside, when the embankment is breached (and most of the embankments built along the main rivers of North Bihar breach every wet season, often in multiple places), a deluge results. 'Because of embankment, not because of floods, North Bihar is drowning together with its inhabitants', Poddar Babaji tells me.

The second way in which embankments have influenced the hydrology of the rivers of North Bihar is a function of water velocity and consequent sediment load. Embanked, contained rivers result in water that, by the laws of hydraulics, runs at a higher velocity. Faster-moving water erodes and carries more particles (higher sediment loads). It also carries larger particles, and does so through a turbulent movement. The pre-embankment flow of water, while never laminar, probably allowed for a vertical size-graded sorting, with the top lightest part of the sediments released through the overflow. This stratification is reconfigured in a constrained river. As a result, when the levee is breached, heavier and larger sediments are deposited in the countryside and, instead of fertilizing the soil, they cover and smother it. As any observer of the landscape of North

Bihar can see, many agricultural plots of a land once considered the most fertile in India are now lunar landscapes of sterile and shimmering sand.

Third, the embankment's aggradation of the riverbed threatens to reverse the direction of water in tributaries, hence impeding the river's ability to accomplish one of its main functions, drainage. The sluice gates installed on Bihar's embankments are clogged by the rising riverbed. They cannot be raised, and they will counterproductively channel water *out from* the river instead of *into* the river. Without a way to drain into the river, rain, floodwater, and under-seepage from the embankment jam the alluvial countryside, creating an exceptionally high water table and reversing the direction of groundwater drainage. The river yields groundwater into the countryside instead of draining it out. The resulting bodies of water are often as large as entire villages. Covered in weeds, the water never evaporates, and breeds swarms of mosquitoes. Waterlogging, spread evenly along embankments in the countryside, is harmful to its inhabitants. 'The water below has become water above', comments Poddar Babaji. 'Fertile land has become clogged either with sterile sand or with stagnant water'.

The result of these embankments, when grafted onto real rivers, is the creation of dangerous places where, paradoxically, water and land are far from separate, contrary to the technology's expected outcome. For example, the countryside, formally protected by the embankment, is now in many cases trapped between the sides of the embankments of two different rivers, with seasonal streams flash-flooding the area. These seasonal streams, often first-order tributaries, are generally unmapped, therefore invisible to the decision-makers who decide to construct embankments and the engineers who design them. Abrupt and unexpected, these flash floods do not drain because of the embankments on either side. Near the confluence of higher-order streams, the same may occur, with the embankments creating a cul-de-sac. Similarly, in many places, unfinished embankments or unmatched elevations between tributaries and main streams lead to the backflow of river water, causing inundation and stagnation, as well as reversing the direction of groundwater flow.

By treating a river as a canal, as a matter of water only, embankment policy has set water antagonistically against soil. The second part of this section explains how, as this policy is enacted, the imaginary separation of water from rural life also pits soil antagonistically against water. The embankment attempts the naturalization of a supposed ontological distinction between water and land. In North Bihar, at least, this distinction is, however, materially untenable, resulting in further and more complicated enmeshments. As Poddar Babaji puts it, 'They tried to use land to tie the water, and the result was that it was the water that tied up the land'.

This perspective, that the ontology embedded in embankment theory and policy is at odds with the specific context of North Bihar itself, is loosely related to other studies of the intermingling of water and land in India, such as the flourishing studies of land-water disputes (Adnan 2013; Basu 2007; Cohn 1965; Ramanathan 2011), mining and water pollution (Alvares 2002; Mishra & Das 2017), and over-extraction and allocation conflicts (Cortesi & Joy 2021; Joy, Paranjape, Gujja, Goud & Vispute 2008). Closer interlocutors are Rasmussen (2016), who identifies in the Andes the collision of multiple ways of knowing water; Yates, Harris, and Wilson (2017), who talk about water infrastructure as a product of multiple ontologies; and, even more so, Mathur and da Cunha (2009). As landscape planners, Mathur and da Cunha hold accountable those who transformed the urban landscape of Mumbai without considering its ecological specificities, such as the susceptibility of that particular landscape to soak instead

of drain its excess water, an oversight blamed for the catastrophic 2005 floods. My approach agrees with theirs, in that it assigns blame for ecological disaster to the application of a worldview prizing firmness in the landscape, but differs in the focus of the story it tells. Mathur and da Cunha's account is an argument for seeing Mumbai as an estuary rather than a city, and an estuary that can survive only when accommodating the sea. My approach instead is based on analysing the conceptual underpinnings of different perspectives. I try to superimpose these perspectives (or ontologies) one over the other, like coloured lenses, to emphasize the distinct consequences each entails for our ways of seeing the world. I have so far discussed the ontological perspective of a technology as blueprint and actual enactment.⁹ In the next section, I will focus on the ontology of the human inhabitants of the space around and across embankments.

Associating the dynamic but intimate relation of land and water in the environment with the cognitive ontology of its human inhabitants responds to the call of one of the fathers of the ontological turn in anthropology – the eclectic Bateson. In *Mind and nature: a necessary unity* (1979) and *Steps to an ecology of mind* (1987), Bateson suggests a reciprocal dependency between the mind and its natural environment, achieving a rapprochement of the human and the nonhuman through the idea of the ecology of the mind, a concept later developed by cognitive ecologists (see J. Sutton 2008; 2014; Tribble & Keene 2011) who theorized that the mind exits the brain and the body and spreads into the world. While never really talking about the environment, Bateson seems to debunk the conceptual containment and isolation of people from their ecology, and consequently also the alienation of the mind and society from the nonhuman milieu. Gibson (1979), with his theory of affordances, later termed ecological psychology, similarly puts in context human (visual) perception and cognition, both in the environment and in everyday life. For Ingold (2000), Gibsonian psychology overcomes the conventional dichotomy between human and nature, although he clarifies that more work is needed to understand the sociality of the experience of the world, which is left unexplored by both ecological psychology and cognitive anthropology. This article is inspired by the attention of these scholars toward de-isolating the human and re-centring the 'mind' (in this case, the social experience of the environment) within a broader ecology. Following their input, I will now expand on the ways in which the inhabitants of the areas inside and across the embankments of North Bihar live and perceive the categories of water and land.¹⁰

Human ontologies of land and water

I study the knowledge of water in its multiple experiential and epistemological realities. My ethnographic work reveals that in North Bihar, neither water nor land can ever be named, let alone understood, without the other. After discussing how embankments have assumed a separation of land and water in theory but created dangerous connections in practice, I will now argue that, in North Bihar, this separation is not only materially but also conceptually untenable. First, I will explain that a perspective of land is meaningless without water; I will then examine the same insupportable separation by focusing on water, which cannot exist without land.

Land

Let us first consider an example to illustrate how land is perceived and evaluated through water. In my years of field research in different locations across North Bihar, I have often asked my interlocutors about the parameters by which they assess land

when purchasing a plot. While I was expecting a distinction in terms of land use and irrigation, my respondents built an intricate 'decision tree'. They examined soil qualities in terms of water, such as moisture retention, but also the acclivity and declivity within the plot and in relation to surrounding lands – in other words, they judged the transitional water topography, or the land's ability to be evenly irrigated without retaining water.

The possibility of being inundated by floods is a crucial parameter for assigning value to land, a sophisticated endeavour since different degrees of likelihood of floods entail different possibilities of land use. If destructive floods are highly probable, for example, a proportion of the soil can be sold, with the expectation that, once the plot is inundated, water will reconstitute land and level out its gradient. Before the inundation or after a mild one, many of my interlocutors said, the lower-lying plot could be exploited as a fishery, or to grow *makhana* (prickly water lily, *Euryale ferox*, economically, nutritionally, and symbolically important in Bihar). The availability of groundwater and the depth at which water can be found are both taken into consideration when assigning value to land that lacks other irrigation infrastructure such as canals, but they were not the first parameters mentioned by my interlocutors. Certainly, socioeconomic features, such as proximity to a road, are also influential in land purchase decisions.

Crucially, however, in all these judgements, land and soil remain conceptually undivided from water, not in metaphorical or interdiscursive narratives, but in the practical and pragmatic ways by which they are reckoned. When I saw soil, land, a barren sandy riverbed, when I pointed and named them *mitti*, *zameen*, *balu*, my interlocutors would identify them with the same words, but they in fact saw something quite different – something whose essence is liquid and wet, and even if dry, nonetheless meaningful according to its watery aspects.

Water

The idea of water is similarly enmeshed with soil, for the characteristics of water, the qualities of drinking water, as well as the success or failure and presence or absence of technologies of extraction and filtration, are discerned by the inhabitants of rural Bihar through water's 'soily' characteristics. Indeed, water is often evaluated through its soily solutes. Among the main sensorially perceived characteristics of water is its texture. In rural Bihar, water is defined as thick or thin, in correlation with its soil content: water with clay is felt as thick, for example, while sandy water tastes thin.

The perception of the colours of water illuminates the same overlap: my interlocutors described the colours of water as a palette of browns, shaded from yellow to black to red. Surprisingly, they rarely described water as blue or green. Based on these perceptions of colours, the water of the river's overflow is defined as good or bad for agriculture, exactly as texture motivates taste. From the colour, people also infer the height of the water, its velocity. They also know the effect on agriculture of each particular water, namely the types of sediments the water will leave behind, the time it takes for them to settle, as well as their effects on the soil's fertility.

To further illustrate how little sense it makes to separate land and water for North Bihar locals, the next example refers to a social movement active in the area with which I have been (proudly) associated for many years. Megh Pyne Abhiyan (literally the 'clouds' water campaign) aims to engage flood-affected inhabitants in rainwater harvesting as an alternative source of drinking water. Rainwater is defined as the purest form of water, to be harvested before it touches the ground. However, in my initial

experience with the campaign, I often perceived dissent on the part of the locals, who described rainwater as brown. The campaign initiative associated water purity with its separation from soil, but the same was not always true for locals, who would not necessarily use the absence of soil as a reference for purity. Only when the campaign strengthened their focus on harvesting water *before* it touches the ground did rainwater begin to be seen in a similar way.

To give another example, the campaign proposed a simple, do-it-yourself sustainable and cheap sand filter, which took time to find favour with the locals. At first, filtering water with sand did not seem very reasonable to everybody. A more complicated version of the filter, however, with added filtering material such as iron nails, carbon, and brick powder, gained ground quickly despite its relatively difficult design and maintenance.¹¹ In fact, in both cases, the vessel was more convincing than the filtering media. The vessel, an earthen pot, was selected by Megh Pyne Abhiyan because of its sustainable price, light ecological footprint, and cultural relevance. Also crucial was the supportive collaboration developed with local potters. The project beneficiaries started to appreciate the filters even more when they realized that the taste of the water was enhanced by the earthen tang of the pot, transforming the water not only into a healthier drink, but also into a kind of valued rarity.

The epistemological intimacy between land and water was also revealed in conversations about groundwater, where the quality of water is defined by the geological stratum of soil from which it is pumped. In its turn, the geological layer is explained by the water that impregnates it, in a chain of mutual reference. Groundwater is qualified by the soil layer from which it was pumped; a given soil stratum, found at a certain site-dependent depth and with specific characteristics, is understood to contain water that is best suited for a specific set of purposes. The inhabitants of each hamlet (men, since women are excluded from the inquiry and stripped of epistemic authority) have a precise understanding of the groundwater profile around their village: each stratum of soil has a name which conveys its soil composition, water content, and common usages. While soil containing clay acquires a multiplicity of names, sandy strata, whose lexicon is much less differentiated, are explained explicitly through the water they release (e.g. *pila-paniwala balu* – ‘the sand of yellow water’).¹² This categorization is increasingly influenced by information on drinking water spread by local authorities such as the Public Health and Engineering department of the district. Such information is further mediated by local contractors and commercial drillers,¹³ but the classification of groundwater according to soil strata prevails in local discourses around drinking water.¹⁴

Groundwater is the most common source for both agricultural and domestic uses despite the abundance of surface water. When a pump is installed or drilled in the ground, water has to be symbolically worshipped through a ritual that physically pours it into the drilling mechanism in order for the soil to release, in return, more water. If machine drilling makes water necessary for cooling the mechanism, it is still considered necessary to pour water into holes drilled using bamboo, a practice not impaired by overheating. It is by inserting water, the drillers say, that pressure is achieved and the pipe (whatever the material) starts emitting both water and soil.

On these occasions, drillers worship the goddess Kamla. The Kamla is in fact a river, a tributary of the river Kosi, in turn a tributary of the Ganga. Stories about the goddess Kamla, whom Brahminical Hinduism incorporates as an avatar of Lakshmi, the goddess of wealth, refer to her desire to satisfy people’s thirst. In folkloric narrations

of the goddess, she is transformed into a jar of water which flows into the river Ganga. I have found drillers worshipping other deities, yet in most of Bihar, the goddess Kamla is believed to be feeding the soil with water. While in Hinduism, worship of a god prior to the use of a technology or prior to a modification of the environment is not uncommon, it is interesting that a river is worshipped while digging in the ground in search for water – even when this happens far away from the Kamla or any other river, a pattern of worship that echoes the sophisticated local knowledge about less-than-apparent ecologies.¹⁵

These examples, concerning (i) the transitional morphology of land considered in property evaluation and decision-making about land use, (ii) the consideration of the water texture and colour in relation to its solutes in order to judge (respectively) taste and irrigation impact, (iii) the experience of Megh Pyne Abhiyan with both rainwater harvesting and water filters, and (iv) the techno-religious practices of categorizing and drilling groundwater, all indicate a specific ontology in which land and water are cognitively intimate. More specifically, they indicate an ontology different from my own, as I will elaborate in the next section.

Situating the ontology

Up to this point, I have examined the technology of embankment in Bihar in its attempt to naturalize the ontological division of two substances, water and land. The unexpected effects of building embankments in Bihar have shown how land and water are not materially 'other', but are joined into unexpected configurations by the very attempt to antagonistically play one against the other. Reconnecting the ecology with the way in which it is thought of by its inhabitants (Anand 2017; Jalais 2010; Rademacher 2011), my ethnographic examples have argued for the inseparability of land and water in the locally shared pragmatic knowledge of such wet contexts. The present section aims to explore the theoretical situatedness of such an analysis and to indicate its potential implications.

While I am aware that the conceptual and material ontologies here elaborated upon have come into being under specific spatio-temporal, thus historical and political, contingencies, I am not attempting to examine their origins. Lahiri-Dutt and Samanta's fascinating work (2013) traces the separation of land and water in Bengal from colonial times. Historical accounts of embankments in Bihar seem to tell a different story: Mishra narrates how the British introduced embankments to India but then soon demolished them because they were found to be counterproductive. The independent Indian government, however, resumed their construction, succumbing to a fascination with the technology and its political and economic convenience (Mishra 2002; 2007; see also Singh 2008; 2011). This is in line with Mosse's (2003) call to historicize the postcolonial interpretation of the colonial period: in his study of irrigation tanks in Tamil Nadu, he demonstrates that they were in disrepair, or had irregular success long before the colonial period, contrary to much of the environmentalist writing on the topic (see also Skaria 1999; D. Sutton 2009).

This is not to avoid political considerations: floods in North Bihar are an example of how, as Haraway puts it, 'the intensified misery of billions of men and women seems organically rooted in the freedoms of transnational capitalism and technoscience' (1997: 3). But there is already accurate work available concerned with clarifying the politics of river embankment in North India (D'Souza 2006; Hill 1997; Mishra 2012b; Singh 2008). While I have not argued for a political teleology (i.e. proposing

‘what it should be’ or retroactively ‘what it should have been,’ à la Povinelli [2012]), my discussion of the ways in which technologies enact, and local inhabitants think about, land and water does not occur in a vacuum. I have showed embankments’ problemat�city within this precise landscape. Elsewhere (Cortesi 2018b), I connect such ontologies and epistemologies to the political context and the broader and relational political economy in which they emerge or take shape.

There is another consideration with political consequences that I wish to engage with here: the semiotic conflict that emerges when different ontologies of nature meet. Ontology often assumes the absoluteness of what is, in fact, a contingent way of dividing the world. When we use the word ‘water’ – or a word that is commonly translated from another language as the English word ‘water’ – when our semiotic object is a liquid glob of aqueous stuff in the world, we perhaps expect everyone to interpret our communicative sign in a similar fashion. We assume that we mean the same thing, the same supposed substance with the same chemical and physical properties, the same boundaries and telic functions (or Aristotelian telic cause, the finality they serve). Instead, as in the story this article tells, this ontological assumption is likely to lead to a semiotic conflict. The meaning of the word ‘water’ is wrongly assumed to have a communicative fixity, a conventional or shared stability – as Putnam (1975) would say, to have an *intension*, a set of conditions or characteristics, that corresponds to an *extension*, in other words that necessarily determines its object, its meaning.

I myself came to question the universality of the map through which I read the world when I realized that my interlocutors in rural North Bihar and I were pointing at the same thing – and even calling it by the same name – while still meaning different things. Where I saw dry sandy land, my local respondents saw water within it, the shallow hole they could dig in the riverbed if they were thirsty or the full river that had just inundated their house and will do so again every so often for a few months. Where I saw water, locals saw the soil within it, in the mud under the surface and in the water’s colour and texture. In general, water without soil is an abstract thing that does not make sense, a substance that does not exist in the real world of North Bihar. Land without water is an absurd idea, static and barren, that does not occur in the world of my interlocutors.

This encounter – similar to somebody from Earth meeting somebody from Twin-Earth where absolutely everything is the same apart from the interpretation of the word ‘water’, a situation that Putnam (1975) sadly does not consider – was nothing short of a semiotic conflict. A semiotic conflict is radically different from an ontological one, where what is at stake is the relation and hierarchy of being between matter, for example humans and nonhumans (see Blaser 2014). In the case of a semiotic conflict, the same sign can be pointing at one interpretant for one person, and at another interpretant for somebody else: a sign apparently shared by interlocutors can still give rise to multiple interpretants.¹⁶

What are the conditions that create this conflict? I argue that the thing we name as water is dependent on a sensorium which is culturally formed into cognitive categories. The link between the sensorium and the material reality is not straightforward, as we do not necessarily adapt our sensorial ability when we encounter a different world and a different set of interlocutors. Instead, we rely on a sclerotic ontology, an ontology that falls prey to the deductive method that favours the type and forgets the token – the same that convinced Bacon (1902 [1620]) to privilege the inductive approach.

There is nothing wrong with an ontology, even a sclerotic one. Order saves us from chaos. I only criticize it for its pretension towards absoluteness, and the conflict this

pretension engenders: any ordering remains a map, which is not to be confused with the territory:¹⁷ a name, that is, not the thing it indicates. When we describe water, most of us – by us I mean me and those who belong to the same community of practice in regard to water – define it as a colourless, tasteless, and odourless liquid (Cortesi in press). However, as Putnam's Twin-Earth story tells us, this description could refer to a number of substances other than water.

Similarly, if prompted, many would define water as H₂O, which is unlikely the only molecule constituting the matter we refer to as water. We do acknowledge certain variations of water and establish boundaries depending on its affordances: drinking water, for example, is assumed to be as close as possible to the colourless, tasteless, and odourless H₂O, while the toxic runoff from a landfill is certainly not the same thing (Cortesi in press). As this article argues, the boundaries of the matter we call water do not exactly correspond, or do not correspond for everyone, to the conventional usage of the word 'water', which signals an ideal type, a stereotype, a non-negotiable category, even while it clearly means a more complex reality. Water is a spontaneous habit, a 'learning 2', as Bateson (1987) would say, a non-deliberate learning that is difficult to unlearn.

In fact, it is not by chance that the conflict is engendered by a natural object. Kripke (1980) isolates natural-kind words as rigid designators because we do not use descriptive properties to define them; in other words, we do not fix their reference by way of a description 'even in talking about counterfactual situations where the thing named would not satisfy the description in question' (e.g. Putnam 1975: 152). We hold a stereotype, an internalized category, even when the thing we point to defies our stereotype in its basic composition. Putnam explains this process of 'absolutization' as a consequence of the unnoticed indexicality of words such as 'water'. He says, '[I]ndexicality extends beyond the obviously indexical words and morphemes . . . [W]ords like water have an unnoticed indexical component. Water is stuff that bears a certain similarity relation to the water around here' (1975: 152, original emphasis). I suggest that here is the water we hold closest to us, the water that we drink, that we obtain from our tap, our bottle, our most common sources. When we talk about water, we think about a token that we make into a type.

The process of absolutization is also a deeply political one. A rigid ontology solidifies even further when it belongs to a more powerful group, and thus reinforces itself at the expense of the ontology of other groups, naturalizing and therefore de-politicizing itself (Cortesi 2018b). My own standpoint was one of privilege, even if relativized by my investment in re-balancing the relation between ontologies as well as in addressing their unequal ground.

As many other anthropologists have previously argued (see Boas and Evans-Pritchard, for example, as discussed in the introduction), ignorance of ontological relativity hinders communication between people with different ontologies. Bacon's warning about not falling prey to the old idols is apt here: do not buy into old ideas about nature that cloud our mind and get in the way of communication (Bacon 1902 [1620]). Although this article narrates the climax rather than the process itself, I hope it is clear how my own sclerotic ontology complicated the communication between my interlocutors in rural Bihar and me – in other words, I, too, have been on both sides of the semiotic conflict explained above.

It is for this reason that I posit a community of practice of sorts, whose members share a certain idea of water. I imagine this is what Putnam meant by Earth or

Twin-Earth. While a community of practice is a loose concept, and each of us belongs to many communities of practice at the same time, it is important to assert that certain people participate in a certain orientation to worldly things that have high stakes, such as water. More precisely, I hypothesize an ontological community, a hypothetical, collective linguistic body whose members share certain assumptions of the word 'water', share a similar way of ordering the world with regard to water.

It is beyond the scope of this article to delimit the contours of one ontological community or the other. Yet it should be clear that the argument presented here does not juxtapose 'Western' versus 'non-Western'. While recognizing the project of tracing broader trends through historically closely connected places (Glacken 1973) and finding common tropes at the origins of our stereotypes, I find 'Western' and 'Oriental/Asian/non-Western' essentializing categories to have little heuristic value as far as the ontologies of water and land are concerned.

Similarly, I do not wish to extend this theory of dualism into opposing the natural sciences with the social sciences. While Putnam (1975) refers to the 'rise of chemistry' as the moment in which the word 'water' entered into a specialized register and started exhibiting a division of labour, after learning about the continuity of water and soil, I found it again in my environmental studies of the hyporheic zone of a stream (a saturated, interstitial zone of exchange beneath the bed and the banks of the stream: Bencala 2005), as well as the study of vadose processes (the ways in which water and air come together with soil in vadose areas: Heinse & Link 2013). Even the basic definition of soil assumes water and air contents together with earth particles.

Yet it is the metaphor of flows and the temporality it instates in the study of water that is the most prevalent contribution that hydrology seems to bring to the social sciences. While the natural sciences, often accused of being rigid, have been able to cross borders, anthropologists frequently limit their understanding by adopting the *wordings* of the physicist and not the *working s/he sees*, which, together with mind-body dualism and certain anti-aesthetic prejudices, is one of the three 'presuppositions or premises of thought' that, according to Bateson (1979: 217, but also throughout his work), render our thinking obsolete. Not changed much since 1979 when *Mind and nature* was published, these presuppositions have instead flourished once more in the social studies of water (Camargo & Cortesi 2019).

This article tries to move beyond the limited erasure of the rigid categories of land and water not only when water flows and crosses the line (e.g. Harris 1998). Do we allow the sea to be, and be thought of as, soil and water together only when the tide erases our footprints on the sand? If we are to take other ways of thinking seriously, flows and rhythms, while useful, cannot cover the spectrum of water and land interactions. It is not only by granting that things are different in different times, but also by recognizing deeper assumptions, that we can resist the absoluteness of certain ways of looking at the world, unlearn unconscious habits that inherently engender discrimination, work through difficulties in the semiotic communication with people who order the world differently, and pursue the difficult path towards environmental justice.

Conclusion

By positioning my discussion at an ontological level, closer to the cognitive and the epistemological, in this article I try to push further the investigation of the conceptual separation of land and water. With the ethnography of the rivers' embankments in North Bihar, I have highlighted their complex interactions with the materiality of

the local ecology and with local ontologies. With the ethnography of land and water practices in North Bihar, we have seen that land is meaningless without water, and water, in turn, is meaningless without land. Finally, I have proposed an interpretation of my initial conversations about water as a semiotic conflict, a conflict based on a sclerotic ecology of water that I share with others. A corollary to this interpretation is the hypothesis that I belong to a linguistic community of practice, or, more precisely, an ontological community of people who share similar suppositions about water. I finally suggest a political component of such interactions. By so doing, I hint at a comparative ontology – a method of understanding an ontology by comparing it to another, instead of axiologically, in relation to one value system or the other.

When I referred to water as a speaker of the above-mentioned community of practice, I had in mind a fiction of colourless, tasteless, pure liquid, even if at times I perceived and discussed the taste of water and its colour. Somehow, when I meant drinking water, I had an alterity in mind, the idea of absolute, pure H₂O, even if, at another level, I was very aware that the aqueous solution I consider potable is richer and more complex than that. My respondents in Bihar would never drink mud, but they envision that water purity occurs across a gradient where soil content is less an absolute property and is instead relative to a scale that considers other variables.

As a result of such elaborations, I have argued that water and land, at least in flood-affected North Bihar, are in reciprocal cognitive correspondence, necessarily embedded in contingent sociopolitical perspectives and environmental configurations, yet intimately tied to each other in a way that erases their boundaries.¹⁸ The ontology of land and water in North Bihar demonstrates instead how water and land transcend their boundaries and are indispensable to each other. They are two facets of the same substance, and each one is the reference for understanding the other. The cultural ways in which people separate soil and water can be framed as disconnections that imply the same relationship as a connection. Yet while embankments, in theory and practice, imply a contested alterity and rivalry between water and land, the examples of local practices, illustrating both experience and reasoning, reflect their deeper ontological and epistemological intimacy.¹⁹

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NOTES

¹ This work is situated within a broader study of the experience and the environmental knowledge of water. I discuss elsewhere the experience of floods, their meaning as a disaster, and their metaphysical and political connotations (Camargo & Cortesi 2019; Cortesi 2018a; 2018b).

² See Kelly (2014) for a clear discussion on this.

³ The term 'materiality' is used here to refer to material presence and characteristics (for debate on this, see Ingold 2007; 2012).

⁴ Embankments were also constructed in Bihar, but not all embankments are the same. Small earthen structures, often called *bund*, were built with the aim of temporarily controlling the river's flow of both silt and water, diverting it from the main course into the fields or away from inhabited areas, to either irrigate and fertilize or drain. When used to protect villages from water, the *bund* was often circular, as described by many of my interlocutors (see also Mishra 2003). Instead of *bunds*, today locals prefer to construct their villages on elevated land, and build up soil before settling down (or re-settling after floods) in an area.

⁵ Saliiently discussed by Dinesh K. Mishra in so many of his insufficiently acknowledged publications (e.g. 2012a). I also wish to thank him for his many generous conversations with me over the last decade or so.

⁶ Interestingly, Latour similarly uses the example of engineering rivers. He also cites a water specialist, trained from his youth in the culture of the water-pipe, who admits, 'Nobody imagined that their isolated actions would have repercussions' (1998: 240, fn. 28).

⁷ The master trope of the walled city and its effects are discussed in detail in Cortesi (2018a).

⁸ Thanks to Veronica Strang for this helpful reference.

⁹ My proposed re-centring of technology and its parallelism with the human does not stem from a concern with the ethical and political ends of 'nonhuman actors' (Castree 2004; Winner 1986) so-called in the ontological work of Latour and Callon (Law 1999). Rather, from science and technology studies, I borrow a perspective on how technologies can incarnate a certain thinking and enact it in their being in the landscape (Carse 2014; Winner 1986).

¹⁰ This article is about the opposition between two different ontologies, broad ways of looking at the world, rather than sub-groups' differences. This argument's relevance rests precisely on the fact that this ontology is widespread across social axes of differences, such as caste, religion, age, occupation, and gender (see Cortesi 2018b for more attention on such social categories).

¹¹ The second version was in fact more effective at chemically, and not only physically, removing contamination, but that was not the reason for its acceptance (see <https://meghpyneabhiyan.files.wordpress.com/2011/12/matka-filter-local-earthen-filter2.pdf>, accessed 10 August 2021). The filter is in fact a simplified version of the SONO Arsenic filter (Hussam & Munir 2007).

¹² *Doras mitti*, *chikni mitti*, *kala mitti*, and *lal mitti* are local names for different clay-based soils. More folk classifications of soils are given in Cortesi (2018b) but also in Conklin (1954) and in Gupta (1998).

¹³ Drilling is a professional activity relatively common in the area, with a few families engaged in the profession every block or so. It is notably unrelated to caste.

¹⁴ Discussed in detail in Cortesi (2018a).

¹⁵ This example does not imply that views on water and land originate from religious cosmologies. While I write about Muslims' relation to water elsewhere (Cortesi & Westerkamp 2021), those who inhabit my fieldwork area mostly share the ontology of land and water described in this article.

¹⁶ For the non-obvious definition of sign, object, and interpretant, see Kockelman's work (in particular 2015).

¹⁷ See Korzybski's (1933) principle that 'the map is not the territory'.

¹⁸ In this theorization of 'the muddy space', I refuse to use the word 'hybrid', a loan word from genetics that indicates a mix of two characters, of two discrete entities that are indeed different and together only by chance while normally separate.

¹⁹ This article is closely complemented by another paper on the knowledge of a watery space (Cortesi 2018b), where I examine mud, which is more than water and soil together, and which constitutes the surfaces over which people live while at the same time becoming a constituent of their life, as well as their death. Mud is an affordance of the livelihood of people in rural North Bihar, to be known and mastered as a way of attending to the landscape. Mud is the material and meaning of belonging to that land and aspiring to social status at the same time, which my ethnographic experience found particularly evident through the practices of women across middle and lower castes. It is the object that problematizes the distinction between soil and

water, but more fundamentally, it is a quasi-substance that disrupts the conceptual separation between liquid and solid, and hence the very foundational categories of our physics.

REFERENCES

- ADNAN, S. 2013. Land grabs and primitive accumulation in deltaic Bangladesh: interactions between neoliberal globalization, state interventions, power relations and peasant resistance. *Journal of Peasant Studies* 40, 87-128.
- ALVARES, C. 2002. *Fish curry and rice*. Mapusa: The Goa Foundation.
- ANAND, N. 2017. *Hydraulic city: water and the infrastructures of citizenship in Mumbai*. Durham, N.C.: Duke University Press.
- ASTUTI, R. 2017. Taking people seriously (the 2015 Robert H. Layton lecture). *HAU: Journal of Ethnographic Theory* 7, 105-22.
- BACON, F. 1902 [1620]. *Novum organum scientiarum*. New York: P.F. Collier.
- BARRY, J.M. 1997. *Rising tide: the Great Mississippi Flood of 1927 and how it changed America*. New York: Touchstone.
- BASU, P.K. 2007. Political economy of land grab. *Economic and Political Weekly* 42, 1281-7.
- BATESON, G. 1979. *Mind and nature: a necessary unity*. Toronto: Bantam Books.
- 1987. *Steps to an ecology of mind: collected essays in anthropology, psychiatry, evolution, and epistemology*. Chicago: University Press.
- BENCALA, K. 2005. Hyporheic exchange flows. In *Encyclopedia of hydrological sciences* (ed.) M.G. Anderson, 1733-40. Chichester: Wiley.
- BLANCO, T.F., J.D. GODINO & J.A.C. PEGITO 2012. An onto-semiotic approach to geometrical reasoning and spatial visualization. *Bolema – Boletim de Educação Matemática* 26, 39-64.
- BLASER, M. 2014. Ontology and indigeneity: on the political ontology of heterogeneous assemblages. *Cultural Geography* 21, 49-58.
- BOAS, F. 1881. *Contributions to understanding the color of water*. Thesis, University of Kiel.
- 1938. An anthropologist's credo. *Nation* 147, 201-4.
- BURGOS, M. & J.D. GODINO 2020. Semiotic conflicts in the learning of proportionality: analysis of a teaching experience in primary education. *International Electronic Journal of Mathematics Education* 15: 3, art. em0558.
- CAMARGO, A. & L. CORTESI 2019. Flooding water and society. *Wires Water* 6: 5, art. e1374.
- CARSE, A. 2014. *Beyond the Big Ditch: politics, ecology, and infrastructure at the Panama Canal*. Cambridge, Mass.: MIT Press.
- CASTREE, N. 2004. The geographical lives of commodities: problems of analysis and critique. *Social & Cultural Geography* 5, 21-35.
- COHN, B. 1965. Anthropological notes on disputes and law in India. *American Anthropologist* 67, 82-122.
- CONKLIN, H.C. 1954. Section of Anthropology: an ethnoecological approach to shifting agriculture. *Transactions of the New York Academy of Sciences* 17: 2, 133-42.
- 1955. Hanunoo's color categories. *Journal of Anthropological Research* 42, 441-6.
- CORTESI, L. 2018a. *Living in unquiet water: knowledge and technologies of disastrous floods and drinking water contamination in North Bihar, India*. Unpublished Ph.D. dissertation, Yale University.
- 2018b. The muddy semiotics of mud. *Journal of Political Ecology* 25, 617-27.
- in press. Hydrotopias (Introduction to the SI on Land/Water). *Geoforum*.
- & K.J. JOY (eds) 2021. *Split waters: the idea of water conflicts*. London: Routledge.
- & W. WESTERKAMP 2021. The shape of waterland: a geo-morpho-anthropological commentary on institutional infrastructures of fluvial management and amphibious knowledge. Unpublished typescript.
- D'SOUZA, R. 2006. *Drowned and dammed: colonial capitalism and flood control in eastern India*. New Delhi: Oxford University Press.
- DESCOLA, P. 2013. *Beyond nature and culture* (trans. J. Lloyd). Chicago: University Press.
- 2014. Modes of being and forms of predication. *HAU: Journal of Ethnographic Theory* 4, 271-80.
- EVANS-PRITCHARD, E.E. 1940. *The Nuer: a description of the modes of livelihood and political institutions of a Nilotic people*. Oxford: Clarendon Press.
- FUSTEL DE COULANGES, N.D. 1874. *The ancient city: a study on the religion, laws, and institutions of Greece and Rome*. Kitchener, Ont.: Batoche Books.
- GIBLETT, R. 2013. *Black swan lake: life of a wetland*. Bristol: Intellect Books.
- GIBSON, J. 1979. *The ecological approach to visual perception*. Boston: Houghton Mifflin.

- GLACKEN, C.J. 1973. *Traces on the Rhodian shore: nature and culture in Western thought from ancient times to the end of the eighteenth century*. Berkeley: University of California Press.
- GRAEBER, D. 2015. Radical alterity is just another way of saying 'reality': a reply to Eduardo Viveiros de Castro. *HAU: Journal of Ethnographic Theory* 5, 1-41.
- GREGORY, D. 2001. (Post)colonialism and the production of nature. In *Social nature: theory, practice and politics* (eds) N. Castree & B. Braun, 84-111. Malden, Mass.: Blackwell.
- GUGLIELMINI, D. 1697. *Della natura de' fiumi: trattato fisico matematico*. Bologna: Stamperia di Lelio della Volpe.
- GUPTA, A. 1998. *Postcolonial development: agriculture in the making of modern India*. Durham, N.C.: Duke University Press.
- HARAWAY, D. 1997. *Modest_Witness@Second_Millennium: FemaleMan@_Meets_Oncomouse*. London: Routledge.
- HARRIS, M. 1998. The rhythm of life on the Amazon floodplain: seasonality and sociality in a riverine village. *Journal of the Royal Anthropological Institute (N.S.)* 4, 65-82.
- HEINSE, R. & T.E. LINK 2013. Vadose zone processes: a compendium for teaching interdisciplinary modeling. *Journal of Contemporary Water Research & Education* 152, 22-31.
- HENARE, A., M. HOLBRAAD & S. WASTELL 2007. *Thinking through things*. London: Routledge.
- HILL, C.V. 1997. *River of sorrow: environment and social control in riparian North India, 1770-1994*. Oxford: University Press.
- HUSSAM, A. & A.K.M. MUNIR 2007. A simple and effective arsenic filter based on composite iron matrix: development and deployment studies for groundwater of Bangladesh. *Journal of Environmental Science and Health Part A* 42, 1869-78.
- INGOLD, T. 2000. *The perception of the environment: essays in livelihood, dwelling*. London: Routledge.
- 2007. Materials against materiality. *Archaeological Dialogues* 14, 1-16.
- 2012. Toward an ecology of materials. *Annual Review of Anthropology* 41, 427-42.
- JALAIS, A. 2010. *Forest of tigers: people, politics and environment in the Sundarbans*. New Delhi: Routledge.
- JOY, K.J., S. PARANJAPE, B. GUJJA, V. GOUD & S. VISPUTE 2008. *Water conflicts in India: a million revolts in the making*. New Delhi: Routledge.
- KELLY, J.D. 2014. The ontological turn: where are we? *HAU: Journal of Ethnographic Theory* 4, 357-60.
- KOCKELMAN, P. 2010. *Language, culture, and mind*. Cambridge: University Press.
- 2015. Four theories of things: Aristotle, Marx, Heidegger, Peirce. *Signs and Society* 3(1). <https://doi.org/10.1086/679706>.
- KOHN, E. 2013. *How forests think: towards an anthropology beyond the human*. Berkeley: University of California Press.
- 2015. Anthropology of ontologies. *Annual Review of Anthropology* 44, 311-27.
- KORZYBSKI, A. 1933. *Science and sanity: an introduction to non-Aristotelian systems and general semantics*. Englewood Cliffs, N.J.: Institute of General Semantics.
- KRIPKE, S. 1980. *Naming and necessity*. Cambridge, Mass.: Harvard University Press.
- LAHIRI-DUTT, K. 2015. Towards a more comprehensive understanding of rivers. In *Living rivers, dying rivers* (ed.) R. Iyer, 421-34. New Delhi: Oxford University Press.
- & G. SAMANTA 2013. *Dancing with the river: people and life on the chars of South Asia*. New Haven: Yale University Press.
- LATOUR, B. 1998. To modernize or to ecologize? That's the question. In *Remaking reality: nature at the millennium* (eds) B. Braun & N. Castree, 221-42. London: Routledge.
- LAW, J. 1999. *Actor network theory and after*. Oxford: Blackwell.
- LINTON, J. & J. BUDDS 2014. The hydrosocial cycle: defining and mobilizing a relational-dialectical approach to water. *Geoforum* 57, 170-80.
- MATHUR, A. & D. DA CUNHA 2009. *Soak: Mumbai in an estuary*. New Delhi: Rupa & Co.
- MAYÉN, S., C. BATANERO & C. DÍAZ 2009. Conflictos semióticos de estudiantes mexicanos en un problema de comparación de datos ordinales. *Revista Latinoamericana de Investigación en Matemática Educativa* 12, 151-78.
- MISHRA, D.K. 1997. The Bihar flood story. *Economic and Political Weekly* XXXII, 2206-17.
- 2001. Living with floods. *Economic and Political Weekly* XXXVI, 2756-61.
- 2002. *Living with the politics of floods*. Dehradun: People's Science Institute.
- 2003. Life within the Kosi embankments. *Water Nepal* 10, 277-301.

- . 2007. Bihar floods of 2007: some lessons for everyone. SANDRP, November–December (available online: https://sandrp.files.wordpress.com/2018/03/bihar_floods_dkmishra_dec2007.pdf, accessed 11 August 2021).
- . 2012a. *River Bagmati: bounties become a curse*. Dehradun: People's Science Institute/SANDRP.
- . 2012b. Resuscitating a failed idea: notes from Bihar. *Economic and Political Weekly* XLVII, 48–51.
- & N. DAS 2017. Coal mining and local environment: a study in Talcher coalfield of India. *Air, Soil and Water Research* 10(1). <https://doi.org/10.1177/1178622117728913>.
- MITCHELL, T. 2002. *Rule of experts: Egypt, techno-politics, modernity*. Berkeley: University of California Press.
- MOSSE, D. 2003. *The rule of water: statecraft, ecology, and collective action in South India*. New Delhi: Oxford University Press.
- POVINELLI, E.A. 2012. The will to be otherwise/the effort of endurance. *South Atlantic Quarterly* 111, 453–75.
- PUTNAM, H. 1975. The meaning of 'meaning'. *Minnesota Studies in the Philosophy of Science* 7, 131–93.
- RADEMACHER, A. 2011. *Reigning the river: urban ecologies and political transformation in Kathmandu*. Durham, N.C.: Duke University Press.
- RAMANATHAN, U. 2011. Land acquisition, eminent domain and the 2011 bill. *Economic and Political Weekly* XLVI, 10–14.
- RASMUSSEN, M.B. 2016. Water futures: contention in the construction of productive infrastructure in the Peruvian highlands. *Anthropologica* 58, 211–26.
- SINGH, P. 2008. The colonial state, zamindars and the politics of flood control in North Bihar (1850–1945). *Indian Economic and Social History Review* 45, 239–59.
- . 2011. Flood control in North Bihar: an environmental history from the 'ground-level' (1850–1954). In *The British empire and the natural world: environmental encounters in South Asia* (eds) D. Kumar, V. Damodaran & R. D'Souza, 160–80. New Delhi: Oxford University Press.
- SKARIA, A. 1999. *Hybrid histories: forests, frontiers, and wildness in western India*. New Delhi: Oxford University Press.
- SUTTON, D. 2009. *Other landscapes: colonialism and the predicament of authority in nineteenth-century South India*. New Delhi: Orient Blackswan.
- SUTTON, J. 2008. Material agency, skills, and history: distributed cognition and the archaeology of memory. In *Material agency: towards a non-anthropocentric approach* (eds) L. Malafouris & C. Knappett, 37–55. Berlin: Springer.
- . 2014. Memory perspectives. *Memory Studies* 7, 141–5.
- TRIBBLE, E.B. & N. KEENE 2011. Introduction: Cognitive ecologies, distributed cognition, extended mind and memory studies. In *Cognitive ecologies and the history of remembering: religion, education and memory in early modern England* (eds) E.B. Tribble & N. Keene, 1–18. Basingstoke: Palgrave Macmillan.
- VENKATESAN, S., M. CARRITHERS, M. CANDEA, K. SYKES & M. HOLBRAAD 2010. Ontology is just another word for culture. *Critique of Anthropology* 30, 152–200.
- VIVEIROS DE CASTRO, E. 2012. *Cosmological perspectivism in Amazonia and elsewhere*. Chicago: HAU Books.
- WINNER, L. 1986. Do artefacts have politics? In *The whale and the reactor: a search for limits in an age of high technology*, 19–39. Chicago: University Press.
- WORSTER, D. 1985. *Rivers of empire: water, aridity, and the growth of the American West*. New York: Pantheon Books.
- YATES, J.S., L.M. HARRIS & N.J. WILSON 2017. Multiple ontologies of water: politics, conflict and implications for governance. *Environment and Planning D: Society and Space* 35, 797–815.

Une ontologie de l'eau et de la terre dans le nord de l'État du Bihar, en Inde

Résumé

Au pied de l'Himalaya, la plaine indo-gangétique est une terre inondable que l'eau des fleuves modèle et détruit sans cesse. Les mesures de prévention des inondations, qui visaient à séparer les terres productives de l'eau de la rivière par des levées de terre, ont en réalité aggravé les inondations, perturbant le flux bénéfique des eaux de crue chargées de terre, empêchant le drainage et produisant de vastes zones gorgées d'eau. L'autrice avance que l'échec du contrôle des inondations dans l'État du Bihar, en Inde, résulte d'une erreur qui consiste à envisager la rivière uniquement comme un cours d'eau et à tenter ainsi la naturalisation conceptuelle d'une distinction ontologique, en réalité toute relative, entre l'eau et la terre. Il s'avère que dans le savoir local, l'eau ni la terre ne peuvent même être nommées, a fortiori comprises, l'une sans l'autre. Éclairé par un travail ethnographique de terrain et des recherches pluridisciplinaires menés dans le nord de l'État du Bihar, cet article présente la terre et l'eau comme étant en rapport étroit l'une avec l'autre. Il confronte cette rencontre ethnographique à d'autres ontologies de l'eau dans lesquelles les deux éléments

sont opposés. De ce fait, l'article postule des ontologies de substances naturelles qui seraient « étanches », sclérosées, mutuellement exclusives, incapables de s'adapter et sujettes à des conflits sémiotiques.

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