

“The Hydrologic Cycle and the Hydrosocial Cycle: Bridging Hydrosystems and Hydropolitics”

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Let's start with a quote from David Mosse¹:

“The relationship between water and society is as complex an historical, sociological, and regional problem as any that can be imagined.”

For this seminar, I want to think about ways of theorizing this relationship: How are we to think about and represent this complex relationship between water and society? The concept that I want to put forward for this purpose is the “hydrosocial cycle”. This is an emerging concept that is being developed by geographers working in the tradition of the political economy and political ecology of water. It is a concept that incorporates longstanding themes in the history and politics of water as well as newer approaches drawn from political ecology and science studies.

1. The Hydrologic Cycle and the “Modern Water” Paradigm.

We will begin by considering the construction, or genealogy, of the hydrologic (or hydrological) cycle, which has been an extremely successful concept. We are all familiar with classic representations of the hydrologic cycle, which is considered as the main principle, or framework, of hydrological science. Every standard hydrology textbook features an illustration of the hydrologic cycle and a statement to the effect that this concept forms the basis of the science of hydrology. What began as a scientific concept has found its way into popular culture. The standard diagram of the hydrologic cycle, for example, is found not only in hydrology textbooks, but in more popular school textbooks and other publications, on posters and the internet.

Figure 1: Classic representation of the hydrological cycle²

The hydrologic cycle represents the work of generations of hydrological scientists to isolate

¹ Mosse, D. (2003). *The Rule of Water: Statecraft, Ecology and Collective Action in South India*. New Delhi, Oxford University Press, p. 1

² Source: United States Geological Survey / National Atlas of the United States.

and describe the behaviour of water in the hydrosphere. As stated in a typical hydrology textbook:

“The hydrologic cycle is the most fundamental principle of hydrology. Water evaporates from the oceans and the land surface, is carried over the earth in atmospheric circulation as water vapor, precipitates again as rain or snow... and ultimately, flows out into the oceans from which it will eventually evaporate once again. This immense water engine, fuelled by solar energy, driven by gravity, proceeds endlessly in the presence or absence of human activity.”³

While people have always had (and have long debated) ideas concerning hydrological phenomena, the term “hydrologic cycle” and the diagram to represent this concept are quite modern. They were first presented by the American hydrologist, Robert Horton, in a paper read before a meeting of the American Geophysical Union in 1931. The hydrologic cycle was presented by Horton as a framework for the new science of “hydrology” that hitherto had not been recognized as a separate and distinct science in the United States. As Horton then pointed out,

“Defining science as correlated knowledge, it is true that a statement of the field, scope, and status of hydrology at the present time may be little more than a birth-certificate...

“[H]ydrology may be regarded as charged with the duty of tracing and explaining the processes and phenomena of the hydrologic cycle, or the course of natural circulation of water in, on, and over the Earth’s surface. This definition has the advantage that it clearly outlines the field of hydrologic science.”⁴

And Horton introduced the first diagram to depict this concept:

Figure 2 : The Hortonian hydrological cycle⁵

The hydrologic cycle can thus be considered a social construction, which has a definite history and which was produced in a specific scientific and political context in the early 1930s. The diagram itself was an important contribution to our modern understanding of the nature of water. While subsequent diagrams have been greatly simplified, idea of depicting ‘the natural circulation of water’, as Horton described it, makes an important contribution to our cultural appreciation of water as an abstract and universal substance and process.

This way of seeing and understanding the nature of water was convenient to the modern state. The hydrologic cycle was quickly taken up by planning agencies of the US federal government as a means of envisioning the nation’s water resources and rendering them as a “calculable coherence”, to use Heidegger’s term.⁶ The 1930s in the United States was probably the height of what Karen Bakker and others have described as the “state-

³ Maidment, David R., ed. 1993. *Handbook of Hydrology*. New York: McGraw-Hill Inc., p. 1.3

⁴ Horton, Robert E. 1931. The Field, Scope, and Status of the Science of Hydrology. *Transactions, Am. Geophysical Union* 12:189-202, p. 190, 192.

⁵ *Ibid.*, p. 193

⁶ Heidegger, Martin. 1977. *The Question Concerning Technology and Other Essays*. Translated by W. Lovitt. New York: Harper and Row, p. 21.

hydraulic paradigm.”⁷ This paradigm was typified by an emphasis on the development of water supplies by the agencies of the state, the view of water as a ‘resource’, and large scale infrastructure symbolized by large dams, of which the Hoover Dam (completed in 1935) was emblematic.

The first simplified version of the hydrologic cycle diagram was produced by a US federal government agency shortly after Horton's paper appeared. The National Resources Board was concerned with strengthening the federal government's capacity to assume control of the nation's water resources. As a means of making water legible for administrative purposes, the hydrologic cycle was an instrumental component of the state hydraulic paradigm.

Figure 3: Precipitation and the Hydrologic Cycle⁸

The state-hydraulic paradigm was also characterized by the concept of ‘water management’, i.e. the notion that water was a discrete resource that could be exploited and manipulated without explicit regard for the complexity of relations between water and ecosystem functions and between water and human society. The hydrologic cycle fit nicely within this paradigm as a way of representing water as a pure hydrologic process, that is, as an epistemological tool for disentangling water from ecology and from human society.

This idea of water as an abstract substance is what I call “modern water”.⁹ Modern water is a way of knowing, representing and relating to water. It an intellectual achievement that rests on the Cartesian mind-body/culture-nature dualism. Modern water abstracts all the worlds waters from their social, cultural, religious and ecological contexts, reduces them to a single substance, and renders them commensurable, making them suitable for the application of instrumental reason. Essentially, it is a ‘scientific’ way of knowing and representing water.

The origins of modern water can be traced to the 17th and 18th century scientific revolution, and are evident in the common dictionary definition of water describing water as a chemical compound, for example,

“water... 1. Colourless transparent tasteless scentless compound of oxygen and hydrogen in liquid state convertible by heat into steam and by cold into ice, kinds of liquid consisting chiefly of this seen in sea, lake, stream, spring, rain, tears, sweat, saliva, urine, serum, etc...”¹⁰

By reducing the world's waters to a common substance all waters are made commensurable, in accordance with Galileo's famous dictum, “*The book of nature is written in the language of mathematics.*” As R.G. Collingwood argues in his history of the idea of nature, from a world of qualitative differences natural philosophy has effected “*the restriction of natural reality to a complex of quantities*” of which “*nothing is scientifically knowable except what is measurable.*”¹¹ Such has been the case with water. Today, we

⁷ Bakker, Karen J. 2003. *An Uncooperative Commodity: Privatizing Water in England and Wales*. Oxford, UK: Oxford University Press.

⁸ U.S. National Resources Board 1934. “A Report on National Planning and Public Works in Relation to Natural Resources Including Land Use and Water Resources”

⁹ Linton, Jamie. 2010. *What is Water? The History of a Modern Abstraction*. Vancouver, British Columbia: UBC Press.

¹⁰ Concise Oxford Dictionary, 5th ed. 1471

¹¹ Collingwood, R.G. 1945. *The Idea of Nature*. Oxford: Oxford University Press, p. 103.

take it as quite natural that water should be regarded as a universal substance. However, as the historian of science, Christopher Hamlin has shown, throughout the Western world, people perceived the water element to be different from one instance to another, in accordance with the particularities of culture and place. Such “premodern waters” as Hamlin identifies them, were incommensurable.¹²

The point I want to stress is that there is an internal coherence between the modern way of knowing and representing water, the consolidation of hydrological expertise, and the power of the state in managing or controlling water.

And yet, when it comes to water, *We Have Never Been Modern*, to quote Latour’s well-known 1993 work.¹³ Modern water rests on the presupposition that water and society are fundamentally distinct, which allows us to imagine that we can manipulate water without profound social consequences. This follows Latour’s argument that being modern means subscribing to a particular set of intellectual commitments, the first of which is that “Nature and society must remain absolutely distinct.” However, the very idea of modern water internalizes social practice (hydrological science; water management; the power of the state to control water). While modern water is presented as being devoid of social content, it actually internalizes the disciplinary particularities of the hydrological sciences and the state hydraulic paradigm. Therefore, despite all appearances, when it comes to water, we have never been modern.

This contradiction becomes obvious with the proliferation of hydrosocial hybrids such as the prevalence of water pollution, the extent to which hydrosystems have been regulated by humans, and critical recognition of the social implications of the state hydraulic paradigm and acknowledgement that it is impossible to effect changes in the hydrologic cycle without effecting changes in society, the most obvious example being awareness of the social effects of large dams. In the face of such contradictions, modern water is less and less tenable. In fact, as I have argued, modern water is in a state of crisis.¹⁴

This crisis of the concept of modern water is coincident with the general decline of the state-hydraulic paradigm. While there are exceptions (such as in India and China), for the past twenty years, a number of factors have come together to spell its demise. These include a growing awareness of the ecological and social implications of ‘water management’ and fluvial regulation, diminishing supplies of unexploited water, a shift of attention from water supply to various dimensions of water demand, and changing international lending and fiscal circumstances that make water megaprojects more difficult for states to afford. This historic shift is symbolized by the fact that in places like the United States and Western Europe, there are more dams being decommissioned than are being constructed.

2. The Hydrosocial Cycle.

All these factors: intellectual, political, economic, sociological - are giving rise to new ways of understanding the nature of water and new representations of the water process so as

¹² Hamlin, Christopher. 2000. 'Waters: or "Water"?' Master narratives in water history and their implications for contemporary water policy. *Water Policy* 2:313-325.

¹³ Latour, Bruno. 1993. *We Have Never Been Modern*. Cambridge, Mass.: Harvard University Press.

¹⁴ Linton 2010, pp. 191-211.

to incorporate water's fundamentally social nature. These challenge the hegemony of the hydrologic cycle as a means of understanding and representing the water process.

"Evidence now shows that humans are rapidly intervening in the basic character of the water cycle," reports the framing statement of the Global Water System Project, an international research effort that facilitates integrated study of the "biogeophysical and social dimensions of the water system."¹⁵ This statement may be understood in two ways: Clearly, as the authors point out, anthropogenic interventions, such as climate change, basin-scale water balance changes, river flow regulation, sediment fluxes, chemical pollution, microbial pollution, and changes in biodiversity, are "transforming the contemporary global water system." But at the same time, the authors of the paper have themselves transformed the water cycle (see Figure 4). The water cycle is now understood and represented as the integration of physical, biological, biogeochemical, and human components of a more comprehensive system. Now it is the "water system" that represents the nature of water, a nature that is highly complex and highly social.

Figure 4: The Global Water System¹⁶

In this case, the "water system" presents humanity as an undifferentiated whole, a disaggregated abstraction. We know from a rudimentary sense of environmental justice and political ecology however, that humanity is differentiated when it comes to water: there are the water-rich and the water-poor; there are those who benefit from industrial pollution and others who pay the price for industrial pollution. Even in the most water-scarce parts of the world, wealthy people manage to have access to plentiful supplies water for personal and recreational needs. And even in the most water-rich places - such as in Canada - disadvantaged people - such as aboriginal Canadians living in remote communities - endure atrocious water scarcity in the form of undrinkable water supplies.

This idea that humanity is part of the water process is therefore an important point of recognition, but it is not sufficient for a social science of water. In the next illustration, was drawn by Kate Ely, a hydrologist who works with the Confederated Tribes of the Umatilla Indian Reservation, located on the Columbia River Plateau in north-eastern Oregon and south-eastern Washington State. Given the dispossession of the water and other resources of these tribes and the recruitment of the Columbia River into global flows of capital, we can appreciate Ely's perspective: water does indeed flow uphill towards money. The hydrologic cycle, as it exists today, flows in accordance with forces that are political as well as they are hydrological. As Erik Swyngedouw has shown in his work, "the circulation of water - as a physical and social process - brings to light wider political economic, social, and ecological processes."¹⁷ The hydrosocial cycle can be understood as the circulation of water as it is inflected by these wider processes.

Figure 5: "The hydrologic cycle as it occurs today. Water flows to money!"¹⁸

¹⁵ Vörösmarty, C., D.Lettenmaier, C.Leveque, M. Meybeck, C. Pahl-Wostl, J. Alcamo, W. Cosgrove, H. Grassi, H. Hoff, P. Kabat, F. Lansigan, R. Lawlord, and R. Naimann (as members of the Framing Committee of the Global Water System Project). 2004. Humans Transforming the Global Water System. *EOS* 85: 48 (November 30, 2004):509-514, p. 509.

¹⁶ Ibid. p. 509.

¹⁷ Swyngedouw, Erik. 2004. *Social Power and the Urbanization of Water: Flows of Power*. Oxford: Oxford University Press, p. 2.

¹⁸ Available at <http://aquadoc.typepad.com/waterwired/2008/12/postmodern-hydrologic->

Beginning around ten years ago, the term “hydrosocial cycle” has been used by Swyngedouw and other critical geographers to reflect the social dimensions of water.¹⁹ Jessica Budds Rachael McDonnell and I are currently developing the concept by organizing a special issue of the journal *Geoforum* on the theme of the hydrosocial cycle. Here is how we outline the concept:

“The hydrosocial cycle represents and analyses the socio-ecological nature of water, in recognition that hydrological processes are shaped by human activities and institutions, that hydrological data and knowledge are constructed in subjective ways, that water is increasingly recognised as culturally specific, and that the material characteristics of water help shape social relations.”²⁰

The hydrosocial cycle represents the political dimensions of the water process. Whereas the hydrologic cycle serves as a basis for the hydrological sciences, the hydrosocial cycle might serve as a basis for the political ecology of water. By making manifest the political nature of water and its circulation, the hydrosocial cycle has the potential of revealing possibilities for a progressive politics of (hydro)social change.

With this short introduction to the concept of the hydrosocial cycle, two questions remain that I want to address. First, how does the hydrosocial cycle conceptualize / structure the relationship between water and society? And second, in what sense does this relationship constitute a cycle?

3. Hydrosocial Dialectic and “Hydrolectics”

The hydrosocial cycle suggests a dialectical relationship between water and society, which is theoretically rooted in the nature-society dialectic of Karl Marx, as described in his theory of labour (*Capital*, Volume 1, Chapter 7):

“Man opposes himself to Nature as one of her own forces, setting in motion arms and legs, head and hands, the natural forces of his body, in order to appropriate Nature’s productions in a form adapted to his own wants. By thus acting on the external world and changing it, he at the same time changes his own nature.”

The core idea here is that our engagements with nature impact not only on the natural world, but also on ourselves as society. This is particularly salient for water, which figures so importantly in our health, our production, our economy and culture - in the very fabric of our society. This idea has been applied to water most notably via the “hydraulic society” thesis made famous by Karl Wittfogel.²¹ In essence, this theory holds that that the control of water in human history - and especially in arid environments - has produced a certain

[cycle.html](#). Accessed November 5, 2011.

¹⁹ For example, see Bakker, Karen. 2002. From State to Market?: Water *mercantilización* in Spain. *Environment and Planning A* 34 (5):767-790; Budds, Jessica. 2009. Contested H2O: Science, policy and politics in water resources management in Chile. *Geoforum* 40 (3):418-430.

²⁰ Budds, Jessica, Jamie Linton and Rachael McDonnell. 2010. Proposal for a special issue on the theme of the hydrosocial cycle, submitted to the editors of *Geoforum*.

²¹ Wittfogel, Karl August. 1957. *Oriental Despotism : A Comparative Study of Total Power*. New Haven: Yale University Press.

kind of social arrangement, characterized by big bureaucracies and the concentration of state power that Wittfogel characterized as “despotic.”

However, the dialectical relationship between water and society may be understood in a less deterministic way, as allowing for a wide variety of hydrosocial outcomes that continue to evolve. In his book, *Rivers of Empire*, the American environmental historian, Donald Worster, described nature, and in this case, water, “as participating in an unending dialectic with human history...that is, as intertwined in an ongoing spiral of challenge-response-challenge, where neither nature nor humanity ever achieves absolute sovereign authority, but both continue to make and remake each other...”²² Here, the cyclicity of this dialectical process is obvious. The ongoing historical process by which water and society continue to make and remake each other is one way of defining the hydrosocial cycle. Such a concept allows for the twin proposition that “water resources are the product of history” and that “water makes history.”²³

I have used the term “hydroletics” to describe the dialectical process outlined above.²⁴ This describes a dialectical process by which water and people are internally related - how water is the product of social relations and how social relations, in turn, are mediated by water. Understanding water as a hybrid object, we have the potential of changing its constitution by engaging with it in different ways while at the same time producing change in social relations.

As an example, Figures 6, 7, and 8 illustrate two different *kinds* of water, as defined by the social structures and physical infrastructures by which they are made available to people. Figure 6 shows how the use of a public drinking fountain sustains water as a public good, while simultaneously producing a kind of public/citizenship, or “body public”, in which members of a community have equal access to public water services. The fountain, the provision of high-quality water, and the public itself are sustained by the vested interests of fountain-users in maintaining these services. The interruption of this cycle by the strategic placement of a commercial bottled-water vending machine (Figure 7) is illustrated in Figure 8 to show how the diversion of water through private channels has the effect of producing a different kind of access, with the corollary of producing individual consumers rather than a body public. One socio-political effect of sustaining the flow of water through commercial vending machines (and similar means of securing private supplies of water) is suggested by considering how people who procure such private supplies might be less willing to fund public water infrastructure and facilities through their taxes. The general trend of the dereliction of public drinking fountains in many parts of North America might thus be analyzed as a function of this widespread change in the hydrosocial cycle.

Figure 6 : The cycle of public water and the production of a body public: a drinking fountain

Figure 7: Interruption of the cycle of public water: a drinking fountain blocked by a bottled water vending machine²⁵

Figure 8: Diversion from the public water cycle to a private vending machine and the production of individual consumers.

²² Worster, Donald. 1985. *Rivers of Empire: Water, Aridity, and the Growth of the American West*. New York: Pantheon Books, p. 22.

²³ Mosse, David. 2008. Epilogue: The Cultural Politics of Water - A comparative Perspective. *Journal of Southern African Studies* 34 (4):939-948.

²⁴ Linton 2010, op. cit.

²⁵ Photo by J. Linton

Water is a medium of social relations. Different social arrangements and identities are produced as a result of different structures of physical engagement with water. We could cite many examples. In addition to the ones given above, we might consider the social effects of shifting from shared communal sources of water to piped water services. The following quote offers a comment on the relation between engagement with water and the production of society. It describes the effects on a Haudenosaunee (Iroquois) community on the St. Lawrence River in Canada when piped water services were brought to the community and when public access to the river was changed as a result of the flooding of the St. Lawrence Seaway in the late 1950s:

“One participant [in a survey] recalled his mother’s account of changes to her community in relation to changes related to the St. Lawrence River. Between 1920s-50s, everyone was at the river all the time, fishing, running water taxis, doing laundry, and so forth. The river was the social hub of the community. In the 1960s, indoor plumbing was introduced to the community, which cut people off from the river; the society started to deteriorate. Then the seaway was added, and everything changed. It forced many Mohawk men to change livelihoods, from farming to ironwork. He described the seaway as a scar on the heart of people. The community member’s way of thinking was altered as a result of being cut off from the water. Evidently, technological advancements pertaining to water led to social, environmental, and spiritual disconnection.”²⁶

4. Conclusion: The Hydrosocial Cycle and Water Governance

To summarize, we can say that human society and water can have the effect of changing each other by means of their mutual engagements. This dialectical process can be regarded as a kind of cycle that we are calling the hydrosocial cycle. The hydrosocial cycle offers a way of understanding and representing water that brings to light its social nature. Seen through the hydrosocial cycle, the social dimensions water become impossible to ignore and the hydrological influence on society is made manifest.

I want to conclude with the idea that, in contrast with the hydrologic cycle, the hydrosocial cycle corresponds well to emerging ideas and practices of water governance. It may be observed that the state-hydraulic paradigm of "water management" is giving way to new modes of "water governance." The hydrologic cycle works well as a way of representing the nature of water for purposes of water management. This is because the hydrologic cycle conceptually isolates hydrological processes from ecological and social processes, thus making it possible to conceive of manipulating, or managing water as a discrete activity.

The discursive shift from water management to water governance reflects a shift of attention from the isolation, or abstraction of water itself, to the complex relationship between water and people. This shift entails a few key elements involving new actors, new scales and new problems:

First, it recognizes that there are many different legitimate actors involved in making decisions about water. This represents a change from the era of the state hydraulic

²⁶ Lavalley, Giselle. 2006. *Aboriginal Traditional Knowledge and Source Water Protection: First Nations' Views on Taking Care of Water*. Report for the Chiefs of Ontario and Environment Canada, p. 16.

paradigm, in which state agencies and water experts were given authority to manage water on behalf of the public. While state agencies remain powerful players in water management, the shift to water governance recognizes that the private sector as well as non-governmental organizations and citizen groups, watershed-based and other organizations, have a legitimate role to play in making decisions about water and in taking responsibility for these decisions. I would add that this results from, and contributes to, growing acceptance of contested notions of what water is and what it is for.

Second, the shift to water governance involves recognition of the interplay of scales affecting hydrological processes. To be sure, given its apparent hydrological integrity, a great deal of attention is now being directed toward the watershed as an appropriate scale for water governance. At the same time however, there is recognition that social processes operating at a wide variety of scales impinge on hydrological processes. This recognition is reflected in the incongruity between what some researchers have termed the “problemshed” and hydrological processes at the watershed scale.²⁷ And the asymmetry between watershed boundaries and conventional administrative scales is obvious. Whereas the hydrologic cycle directs attention to the watershed, the hydrosocial cycle offers a way of conceptualizing the interplay between social processes operating at various scales and hydrological processes operating at the scale of the watershed.

Third, the idea of water governance reflects a shift in the way we think about approaching water problems, from an emphasis on supply-side solutions to various aspects of water demand. Whereas the management of water supply is the province of hydrologists and hydrological engineers, the management of water demand expands the scope of hydrological expertise to include a much wider range of social actors. To understand water problems as a matter of demand necessarily shifts attention from water itself to the social factors that account for demand, a shift that is conducive to thinking through the hydrosocial cycle.

²⁷ For example, see Griffin, C.B. 1999. Watershed councils: An emerging form of public participation in natural resource management. *Journal of the American Water Resources Association* 35(3): 505-518.