

# Water Resources Research

## EDITORIAL

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### Key Points:

- This Commentary is adapted from the invited talk by Jim Hall at the 2018 AGU Fall Meeting in Washington DC
- The current state of socio-hydrology is reviewed from a personal perspective by one of the editors of Water Resources Research
- The review is based upon the recent Special Section on socio-hydrology in WRR and other influential publications on the topic

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## Socio-Hydrology in Perspective—Circa 2018

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**Abstract** The special section on socio-hydrology is one of most successful in Water Resources Research, containing more than 30 articles, with many more submitted. As we would hope for a special section, this is just the start, and we continue to receive a flow of papers that either explicitly describe themselves as socio-hydrology or are addressing the challenges of coupled human and water systems. In this Editorial, we reflect upon the scope and nature of those articles and make some tentative suggestions about future directions and the realistic ambition for socio-hydrology.

The concept of socio-hydrology has certainly stimulated debate, including by some of the giants of our field, which is surely a good thing. That has enriched the conceptualization of socio-hydrology and begun to fill out a research agenda and methodological toolbox. Socio-hydrology is proving itself to be an interesting and important topic. It is interesting because it tackles profoundly complex phenomena yet has some explanatory power. It is important because socio-hydrology engages hydrological science with some of the most relevant challenges for the Anthropocene.

A review of the papers in the socio-hydrology special section of WRR reveals a great diversity of topics, from theory (such as game theory) through to social surveys, case studies, and narratives. This is to some extent in line with the approaches that were proposed in Siva Sivapalan, Hubert Savenije, and Günter Blöschl's seminal paper in *Hydrological Processes* (Sivapalan et al., 2012), which lists “historical socio-hydrology,” “comparative socio-hydrology,” and “process socio-hydrology” as three avenues through which they expected socio-hydrology to advance. Nonetheless, reviewing the socio-hydrology special section, the methodologic center of gravity is undoubtedly in a variety of model-based approaches, from nonlinear dynamics to agent-based models. Socio-hydrology has, more than anything else, been taken as a license for modelers to expand their horizons.

We receive a number of more empirical papers, but fewer of them self-identify as socio-hydrology. Among the empirical social research manuscripts that we received, these are dominated by surveys and case studies. Though there are some good papers, for the time being, it feels as if this body of work is fragmentary and still very far from representing a deep body of work on the social dimensions of water. Unfortunately, many of the survey papers that we have received recently have rather small sample sizes and address very specific questions in very specific contexts. That, of course, is understandable. Context matters, and we have to be very cautious about generalization. Nonetheless, it feels as though for the time being we just have a tiny number of pieces in an overwhelmingly large puzzle.

We also receive some well-intentioned papers that describe the process of interacting with stakeholders, seeking to learn lessons from those stakeholder engagement processes. There are clearly very many lessons to share on the interface between hydrological science (modeling in particular) and decision making. However, it is extremely difficult to report on these experiences in a scientifically rigorous way. These case studies often arise from “action research” in which the researcher is an active participant in a decision making process. We welcome the fact that hydrologists are increasingly active participants in policy processes, but the insights tend to be anecdotal and probably not repeatable in a scientific sense, so authors struggle to meet the standards of rigor of a journal like WRR.

On the other hand, from a modeling perspective, there has been a rapid proliferation of very innovative models. The standards of modeling are rapidly advancing. Though there is still room for the simple stylized models, like Giuliano di Baldassare's celebrated flood model (Di Baldassarre et al., 2013), there is a growing expectation for empirical validation. Modeling papers that might have been accepted a few years ago are now being rejected because the authors have not done enough to relate them to observable real-world phenomena. This rising standard is a sign of growing maturity.

The scope of human processes that have been explored in socio-hydrology papers is expanding, though it is still incomparable with the depth of our understanding of hydrological processes, even though human processes are immeasurably more complex. To quote from Pete Loucks “There are no laws of social behavior as there are for the physics, chemistry, and biology of water and ecology” (Loucks, 2015). The sociological subject areas covered in the special section include risk communication and the role of the media, social networks, habit forming, and social norms.

One observation that has existed since the original papers on socio-hydrology is the surprising lack of attention to economics. That is surprising as hydroeconomics was already a fairly mature subfield, with its roots in the Harvard Water Programme. Economists are on the quantitative side of the quant-qual schism that exists in the social sciences—so are much more likely bed fellows for hydrologists than more qualitative social scientists. Moreover, economists are used to using mathematics, like differential equations, and constructing stylized models, as well as analyzing data, which are all areas that we have seen also prevail in socio-hydrology. Behavioral economics, which is one of the most important developments in the field of economics, is recognizing the limitation of rational expectations. Many issues, like perceptions, memory, and norms, that have been explored in socio-hydrology papers, are also being explored in behavioral economics, often with rather more rigor. I suggest that it would be fruitful for scholars of socio-hydrology to look much more carefully at the economics literature, especially behavioral economics and the recent rigorous econometrics literature and use of natural experiments and randomized controlled trials.

Another observation that emerges from reviewing the socio-hydrology literature is that critical theory has not yet penetrated any of the writing. We should be careful about what we wish for, as at its worst critical theory can be self-indulgent and impenetrable, but we should be open to critical perspectives. I am far from a critical theorist myself, but someone of that persuasion might observe that in both empirical and model-based work on socio-hydrology, there is a danger of being reductionist and naively simplifying social complexity. There is rather limited self-reflection on the role of the hydrologists as actors ourselves. We are not dispassionate observers, in particular, when we get involved in issues of policy and decision making, which we approach with our own motives and biases. There is practically no attention to political economy: to the exercise of power and power dynamics. In fact, political economists would probably marvel at us placing water at the center of a pre-Copernican universe, as the so-called *master variable*, because it is what we know about, when questions of natural resource overexploitation, which is what socio-hydrology initially sought to explain, are probably much more adequately described by the distribution of power and various actors' political and economic motives.

It is clear that we are at an early stage in socio-hydrology's journey, and I think we need to be realistic, and actually quite modest, about the potential destination. Socio-hydrology started with a bold aspiration to “make predictions” (Sivapalan et al., 2012). We need to be realistic about the fundamental limit to how much we can predict in systems that contain human intentionality. This limit is understood as Shackle-Popper indeterminism (Ben-Haim, 2006): Human behavior is to some extent based on human knowledge; discovery is the process of acquiring knowledge that does not yet exist, so by definition cannot be predicted; and so it is impossible to predict the behavior of humans who are capable of discovery. Subsequent scholars of socio-hydrology seem to have recognized this profound limit on our capacity to predict the outcomes of coupled human-water systems. What socio-hydrology is doing is providing us with new understanding and insights about the dynamic relationship between human systems and the aquatic environment. That understanding can inform the way in which we manage the aquatic environment. In that sense it is surely a worthwhile activity.

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