



**HAL**  
open science

# Challenging the ecological economics of water: Social and political perspectives

Arnaud Buchs, Iratxe Calvo-Mendieta, Olivier Petit, Philippe Roman

## ► To cite this version:

Arnaud Buchs, Iratxe Calvo-Mendieta, Olivier Petit, Philippe Roman. Challenging the ecological economics of water: Social and political perspectives. *Ecological Economics*, 2021, 190, pp.107176. 10.1016/j.ecolecon.2021.107176 . halshs-03330707

**HAL Id: halshs-03330707**

**<https://shs.hal.science/halshs-03330707>**

Submitted on 16 Oct 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

# Challenging the Ecological Economics of Water: Social and political perspectives

Arnaud Buchs, Univ. Grenoble Alpes, Sciences Po Grenoble, CNRS, INRAE, Grenoble INP, GAEL, Grenoble, 38000, France. [arnaud.buchs@sciencespo-grenoble.fr](mailto:arnaud.buchs@sciencespo-grenoble.fr)

Iratxe Calvo-Mendieta, Univ. Littoral Côte d'Opale, Univ. Lille, ULR 4477 - TVES - Territoires Villes Environnement & Société, F-59140 Dunkerque, France. [iratxe.calvo-mendieta@univ-littoral.fr](mailto:iratxe.calvo-mendieta@univ-littoral.fr)

Olivier Petit, CLERSE, Univ. Artois -F-62000, France & Univ. Lille, CNRS, UMR 8019 - CLERSE - Centre Lillois d'Études et de Recherches sociologiques et Économiques, F-59000 Lille, France. [olivier.petit@univ-artois.fr](mailto:olivier.petit@univ-artois.fr)

Philippe Roman, ICHEC Brussels Management School, Brussels, Belgium. [philippe.roman@ichec.be](mailto:philippe.roman@ichec.be)

**Abstract :** This paper introduces the special section entitled 'Ecological Economics of Water: social and political perspectives', which brings together articles published in successive issues of the journal in 2020 and 2021. By discussing the literature, we review contemporary issues and controversies surrounding water management and water policies to highlight the importance of the social and political dimensions that an ecological economics of water should address. We promote comprehensive and reflective approaches that consider seriously institutions and institutional change, e.g. to discuss the role of water-related indicators in water policies. We demonstrate the relevance of this special section that come after two water-related special issues already published in *Ecological Economics*. Finally, we introduce each of the articles of this special section, which we believe can help shape a new avenue of research among ecological economists of water.

**Keywords:** water policy; interdisciplinarity; ecological economics of water; research agenda

## 1. Contemporary issues and controversies in water governance: why do socio-political dimensions matter?

Over the last decades, controversies about water management have abounded. They were fuelled both by real-world events and trends (privatization of water supply services in several cities all around the world, water 'wars' over who governs water treatment and supply and for whom, implementation of water markets, etc.), by institutional discussions (water as an 'economic good' or as a human right, etc.) and by scientific progress (performance indicators of water supply services, neo-institutional analyses of 'optimal' water governance, etc.). Some of the hottest topics regarding water management remain the same today as the ones that prevailed by the end of the 20<sup>th</sup> century: is water an economic good? Should it be managed accordingly and what does it mean? What is the best mix of market and non-market policy tools? Is there (still) a place (and in what circumstances?) for big hydraulic infrastructure development? Should demand-side management be always promoted first? etc. Similarly, questions about valuation are still alive: should economics value water with 'standard'

economic valuation tools (hedonic valuation, travel cost method, contingent valuation, etc.)? Should any monetary valuation ever be made? Such crucial issues are still open to debate and we argue that ecological economists could make a difference in stepping into the conversation and in emphasizing socio-political dimensions. Such discussions are developed in the journal *Ecological Economics* since three decades and can be enriched from a cross-disciplinary dialogue with other fields of study, as done by Kallis et al. (2013) who have developed such a dialogue with Political Ecology.

### Water crises are looming large

Water issues have been widely put to the fore in the scientific and policymaking arenas over the last decades. Water crises have been looming increasingly large, and they are currently recognized as one of the main threats to human development and security, not least for business (World Economic Forum, 2015). As environmental factors become increasingly important among the top risks reported in the Global Risk Report 2020, the 'water crises' item consistently ranks high. And no doubt that water issues, among which water stress, will only be accentuated with climate change. This is therefore no surprise that two of the 17 UN Sustainable Development Goals (SDG) are devoted to water (goal 6 on clean water and sanitation and goal 14 on life below water).

### Several disciplines needed to document these crises

A steadily growing body of work has documented these current and future water crises and put various management issues into question (Allouche et al., 2018; Boelens et al., 2018; La Jeunesse and Larrue, 2019; Dumont et al., 2021, among many others). Beyond hydrology, (hydro)geology and other natural sciences, several disciplines have helped characterize the multifaceted water scarcity and water crises: environmental history (Paavola, 2002), environmental sociology (Poupeau et al., 2016), political ecology (Boelens et al., 2016), critical geography (Norman et al., 2015), gender studies (Ahlers and Zwarteveen, 2009), (water) economics (Garrick et al., 2020), environmental economics (Garrick et al., 2017) and ecological economics (Brouwer and Hofkes, 2008; Calvo-Mendieta et al., 2017) among many others. Critical approaches, mainly in the social sciences, have significantly contributed in understanding of the topic: unveiling the power asymmetries that very often lie behind scarcity and crises; describing in a fine-grained fashion the variegated actors and logics that induce and produce scarcity and crises; identifying those who predominantly bear the burden of scarcity and crises. Such issues have thus been, to a large extent, denaturalized and replaced into their socio-political context (Mollinga, 2020).

### Political and intellectual controversies are still alive

At a more normative level, multi-level, decentralized and polycentric governance have been advocated (Pahl-Wostl, 2009), especially when water is considered as a common pool resource (Villamayor-Tomas, 2018). According to some water experts, great leaps forward have been made at the policy level with the recognition of water as an economic good (Rogers et al., 2002) and as a human right (Salman and McInerney-Lankford, 2004), and more integrated and participative management practices have been advocated around the globe. By the end of the 20<sup>th</sup> century, Integrated Water Resources Management (IWRM) has taken precedence over state-led water management (Biswas, 2004; Merrey et al., 2005; Medema et al., 2008; Petit and Baron, 2009).

But decades of reform of the water agenda have not delivered good quality nor sufficient quantity to all those in need (UN Water, 2020). So, there is no 'end of history' in water management. The field is probably as lively, evolving, and fraught with controversies as three decades ago. Management fads like IWRM or the 'nexus' approaches have come to be challenged, both by practitioners and by scientists (see recent debates in Water Alternatives Forum, 2020<sup>1</sup>). This enduring and heated debate does include the social sciences, but probably too little. Similarly, some ecological economists have taken part in these debates, but arguably in a pretty infrequent and sparse fashion. And we argue that their contribution has seldom relied on approaches rooted in the social sciences. This begs a critical question regarding the current situation: given the broadly acknowledged fact that social sciences could (and some say, should) have played a greater role in these debates and that power and inequality issues have been sidelined in favour of technocratic methodologies, the need for an ecological economic approach investigating the social and political dimensions of water management is certainly of peculiar relevance now.

As a matter of fact, big questions regarding water management and water crises are far from being settled. The very nature, or ontology, of water, has fuelled heated debates: is it a basic good? A human right? A common good? All these dimensions at the same time? Socio-political struggles on the ground (*'luchas por el agua'*, battles against water commodification, privately managed water services, enclosures or water grabbing, etc., in developing as well as developed countries) have, to a certain extent, mirrored academic debates on the scope and limits of water markets and private water services (Meinzen-Dick, 2007; Bel et al., 2010; Grafton et al., 2016; McDonald and Swyngedouw, 2019; Garrick et al., 2020; Marques and Simões, 2020).

#### 'Valuations are always with us' (Myrdal 1978)

Valuation issues are still generating lively debates (Garrick et al., 2017). How should the environment be valued? Since the seminal paper by Costanza et al. (1997) and the subsequent debates about the economic valuation of ecosystem services (ES) or the effectiveness of payments for ecosystem services (PES), most questions posed then remain today: links between ES and human well-being, importance of governance dynamics, equity and justice issues, etc. Value and valuation methods are still largely discussed and debated: should valuation be limited to monetary valuation? Should we use more qualitative and multi-criteria methods? What are the most satisfactory participatory dynamics? Debates in ecological economics, even if they have not reached a unified explanatory framework, have contributed to a more integrated approach to ecological valuation and valuation of damages, risks and services.

The institutions of water management have also sparked a great amount of research and controversy, while fashionable concepts and policy frameworks followed each other. While the widely adopted Integrated Water Resources Management (IWRM) approach has proved versatile and has delivered limited results (Tortajada and Biswas, 2017), what are the current alternatives? The 'nexus' approach (the 'water-energy-food nexus' most notably) has recently gained currency in academic and policy circles with its focus on interrelatedness of issues and its capacity to go beyond the river basin and beyond 'water' as the overarching actor. It has been praised for being more coherent than the IWRM

1 <http://www.water-alternatives.org/index.php/blog/nexus>

paradigm (Muller, 2015) but it has also proved problematic and short of expectations: little real transdisciplinary work and policies have been implemented under the heading of the nexus, and of notable relevance for the present paper, over-reliance on quantitative tools and little use of social science methods have been recorded (Albrecht et al., 2018). This certainly makes room for ecological economists stepping into the debate. Similar shortage of social science inputs/insights has been highlighted regarding 'environmental flows' (Anderson et al., 2019). By the way, the whole practice of determining environmental flows is challenged as they are most often determined in a technocratic top-down way, raising concerns about whose interests such guaranteed flows serve. While it had been widely considered common knowledge and good practice that the most appropriate scale of analysis and action was river basin, such popular belief has also been put under critical scrutiny over the last decades (Waterbury, 1997; Graefe, 2011; Norman et al., 2015). Rather than a silver bullet to water management, this has proven a complex institutional journey with sizeable amounts of failure (see, e.g., Abers and Keck, 2013).

The impetus for and fate of such concepts as IWRM and the nexus testify to the need to find integrative approaches to complex, context-specific water issues that can offer transdisciplinary guidance. In this respect, we believe ecological economics has a role to play. Numerous limitations relative to most currently implemented and worked out frameworks point to a lack of recognition of plural interests and values, or overly technocratic, deterministic and positivist stances (Mollinga, 2020; Kellner, 2021). These concerns straightforwardly echo some of the guiding principles of ecological economics like value pluralism and incommensurability, post-normal science or participative deliberation.

### New approaches and their limitations

While water controversies have kept on running along old issues and new fads, the water research field has also been seized 'from the outside' by new concepts, theories and narratives. Among them, nature-based solutions, planetary boundaries and the circular economy stand out as dominant frameworks. We argue that they would benefit from strengthening their socio-political outlook too.

'Working with nature', 'innovating with nature', 'renaturing cities', 'nature-positive business solutions'... the concept of 'nature-based solutions' (NBSs) has emerged in the 2010s to address global challenges such as climate change, human well-being and biodiversity, while enhancing synergies among the SDGs (Seddon et al., 2019, 2020b). For water resources, NBSs are increasingly seen as innovative and low-cost alternatives to tackle these challenges, while generating multiple benefits (UN Water, 2018; Nika et al., 2020). Even though the European Commission and the UN are promoting the concept and funding research, NBSs remain underdefined (Krauze and Wagner, 2019). EU's definition ('solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions') seems to suffer from the same weaknesses as the concept of sustainable development (Lélé, 1991). Focusing on objectives and aims, concrete criteria are missing and this leaves ample room for interpretation. If some authors see NBSs as the opportunity to 'refocu[s] solutions from technological strategies to socio-ecological principles such as human well-being and community-based governance models' (Gulrsud et al., 2018), EU's ambition is 'to invest in nature and nature-based solutions which can deliver new products and services

(...) to stimulate a market for nature-based solutions' (de Boissezon, 2015). The risk of continuing to do business as usual with new packaging seems real. If NBS are sometimes seen as 'undisputable answers to challenged urban landscapes and societies globally' (Lafortezza and Sanesi, 2019), it seems necessary to clarify the concept (Gómez-Martin et al., 2020; Bridgewater, 2018). Recent research shows that trade-offs and negative effects can be important (Lin and Qi, 2017) and that NBSs need key factors to achieve their potential: analysing institutional frameworks, fostering participation and co-creation process, using transdisciplinary approaches (Kumar et al., 2020; Giordano et al., 2020) or even specific and more important funding (Favre et al., 2017). To avoid perverse effects of NBSs, policies need to be grounded in a holistic approach, with integrated and not sectoralised forms of governance and within an interdisciplinary economic approach (Seddon et al., 2020a).

In recent years, research on 'planetary boundaries' has come to provide the dominant narrative about the state of Planet Earth and its most pressing ecological issues (Rockström et al., 2009). It has been endorsed by both 'renegade' economists (Raworth, 2017) and mainstream environmental economists (Barbier and Burgess, 2017). But concerns have been voiced regarding the potential technocratic and homogenizing content of such a global approach (Pickering and Persson, 2020). Among the nine identified planetary boundaries, 'water' is arguably the one that fuelled greatest controversy (Heistermann 2017), which prompted boundaries scholars to revise the framework (Gleeson et al., 2020). Adapting water planetary boundaries to regional and local scales is a highly challenging issue (Zipper et al., 2020). In addition, the concept has been criticized on grounds of political impacts and governance: 'Moving parameters of earth system governance from policy targets to planetary boundaries hence implies a shift in responsibility, and political power, from the policy-maker to the expert' (Biermann and Kim, 2020: 503).

Much more rooted in business practices than in Earth sciences is the circular economy approach. It has recently gained prominence in governmental institutions, business governance and academia thanks to its simple narrative of 'circularizing linear flows' of matter and energy and its relatively operational orientation. But it has also been criticized for its scientific blind spots (Korhonen et al., 2018) as well as for its technocratic and apolitical leanings (Genovese and Pansera, 2020). The framework has been used in the context of water conservation as a win-win approach (see, e.g., Sartal et al., 2020), which corresponds to the usual narrative around the circular economy (in particular the one promoted by the Ellen McArthur Foundation). Such 'faith' in the benefits of the circular economy has recently been labelled by two prominent ecological economists a 'policy legend' (Giampietro and Funtowicz, 2020).

Current environmental and socio-economic challenges justify the development of an interdisciplinary approach to water politics, considering both lessons from 'hard science' and contributions from critical social science, avoiding narrow economic approaches. To be sure, ecological economics would benefit from stepping aside and looking at what other disciplines have to say about its core topics, among which water scarcity and governance, but at the same time a stronger voice of ecological economists would be of significant value to tackle contemporary issues and controversies in water governance.

## 2. What place for social and political issues in the ecological economics of water?

### 2.1. How does the journal *Ecological Economics* address water issues?

This special section is the third topical collection published in *Ecological Economics* to specifically address water issues. The first special section, published in 2008 and entitled 'Integrated Hydro-Economic Modelling for Effective and Sustainable Water Management' (edited by Roy Brouwer and Marjan Hofkes) postulated that: 'the complexity of interactions between water and the economy can be captured through formal, mathematical models linking relevant hydrological and biogeochemical processes to economic "laws" of supply and demand underlying the provision of scarce water services'. (Brouwer and Hofkes, 2008: 16). The papers selected in this issue develop three types of models: (i) holistic, (ii) modular and (iii) Computable General Equilibrium (CGE), the third type being considered as allowing to capture more precisely the economy-wide impacts of water policy. The social and political dimensions of water were considered as parameters through the baseline and policy scenarios (i.e. structure of water allocation rights, introduction of new water trade systems and the modification of existing economic instruments like water bills, pollution permits, etc.). These dimensions were considered as the context (and the constraints), and constitute one module that interacts with the hydrological system.

The second special section published in *Ecological Economics*, entitled 'Participation and evaluation for sustainable river basin governance', was edited in 2009 by Paula Antunes, Giorgos Kallis, Nuno Videira and Rui Santos. Like the previous one, the starting point of this special section is also methodological, it identifies gaps that it tries to fill, but its approach is quite different as it affirms the need to develop new multi-dimensional, inclusive and plural approaches to water resource management (*ibid*: 931). Here, the pluralism of perspectives (and therefore of values, not limited to economic value) and the complexity of uncertainties imply 'inclusive' governance schemes (*ibid*: 932). The political dimension of the issues at stake (and of the discourses related to them) is claimed and justifies the use of participation (in the broad sense) to account for divergent interests related to water (private, civil society, government, social movements). The inherent complexity of each system (hydrological cycles and biological systems) is reinforced by the pluralism of values and interests. For example, the influence of plural individual values conditions the scope and meaning of willingness to pay (*ibid*: 936). From this point of view, the present special section is probably closer to this second special section than to the first one. The integrated dimension conditions the very definition of the objects that are apprehended thanks to a conceptual model articulating three dimensions: process, information and evaluation. These three dimensions are themselves framed by the institutional, political and socio-economic context in which basin governance takes place. A conceptualization of integration is suggested, namely 'Integrated Deliberative Decision Process (IDDP)', which identifies two levels of integration: between the deliberative processes supporting decision-making (three deliberative methods are analysed in the special issue: participatory modelling, deliberative visioning and social multi-criteria); between deliberative activities and the rest of the decision-making process, i.e. 'its non-deliberative political part, or its normal science part' (Antunes et al., 2009: 937).



## 2.2. How should ecological economics of water shed socio-political light on the debates?

By developing pluri- or interdisciplinary approaches crossing several disciplines in humanities and social sciences and natural sciences, or even transdisciplinary approaches at the crossroads of disciplines and citizen knowledge (Baumgärtner et al., 2008; Borderon et al., 2015), published research in the field of ecological economics of water is primarily dedicated to management, governance, policy and decision-making. This is shown by the content analysis performed in Buchs et al. (2020): most articles addressing water issues published in the journals *Ecological Economics*, *Environmental Policy and Governance* (EPG) and *Environmental Values* (considered as representative of the field) address these issues (37.1% of the segments of abstracts over a corpus made up of 701 abstracts refer to these issues). It is worth noticing that among the three sources, the journal *Ecological Economics* is relatively less representative of this type of concern compared to the other two (notably EPG). *Ecological Economics* is more oriented towards water use issues (especially agriculture water use), monetary valuation and quantitative metrics.

Thus, research in ecological economics seems to be very relevant to feed reflections on the political and social dimensions related to water. We would like to highlight three aspects of this work that we consider relevant and likely to guide future research: comprehensive and reflexive approaches; a critical appraisal of water-related indicators; research that considers institutions seriously.

### Promoting comprehensive and reflexive approaches

Decision making presupposes first having a knowledge of phenomena in their complexity. Therefore, the first aspect we wish to emphasise relies upon the relevance of comprehensive and reflexive approaches, i.e. approaches that attempt to propose a post factum explanation (and not only hypothetical, sometimes tautological). For example, for water scarcity, two types of approaches may be distinguished (Aguilera-Klink et al., 2000): scarcity may be considered as a starting point (i.e. as an exogenous phenomenon, once observed, scarcity is mainly reduced to its physical component) or an arrival point for the analysis. The second type of approach considers that scarcity has geo-physical determinants and is also, to a large extent, a geographically and historically located phenomenon. Preventing and adapting to water scarcity supposes first characterizing and understanding the phenomenon. Here, scarcity is an endogenous and complex phenomenon (articulation between social and physical systems), with a pronounced anthropic dimension, i.e. water scarcity is also a social construct (Becker and Sparks, 2020; Buchs, 2016; Buchs et al., 2020).

### Influencing public policies requires a critical appraisal of water-related indicators

Numerous papers published in the field of water management are based on the analysis of indicators, as tools aiming at better capturing the issues at stake. While we agree with the importance of measuring stocks and flows, it is important to continue developing a critical appraisal of these indicators, because their interpretation is also the reflection of different – and sometimes opposing – ways to understand water management issues. Once again, the attempt to quantify water availability and the interpretation of such figures as a problem of water scarcity is not neutral. Beltran and Kallis (2018) refer to a political ecology approach to combine an analysis of virtual water flows in Palestine with the power relationships which help explain the socio-political aspects of these flows. More



broadly, it is important to keep in mind the necessity to develop a critical appraisal of water-related indicators, since these indicators often contribute to shape policies (Molle and Mollinga, 2003).

### Considering institutions seriously

If we wish to enhance a science that, on the one hand, considers the political and social dimensions of water resources and uses, and on the other hand allows us to have a grip on reality to encourage sustainability, it is necessary to take institutions into account seriously. Indeed ‘sustainability demands changes in both political and economic institutions’ (Vatn, 2020).

In this respect, an ecological economics of water should be based on conceptual tools that account for institutional dimensions. Firstly, at the ontological level, characterizing human-environment interactions requires a clear conceptual framework, and we argue the latter should be deeply anchored in institutional thinking. Several relevant approaches can be put to work: the Environmental governance systems (EGS) framework (Vatn, 2016), Ostrom’s IAD and SES frameworks (Cole et al., 2019), the Institutional resource regimes (IRR) (Gerber et al., 2009), the Water use mode (Buchs, 2016) etc. Secondly, there is a theoretical necessity to develop tools that help understand institutional change: how to understand the articulation between behaviours, rules (institutions) and values? What are the relevant levers to shape them in a more sustainable perspective? On this issue, the perspectives differ (Hall and Taylor, 1996; DiMaggio, 1998; Nielsen, 2001): are institutions the result of past power relations as suggested by proponents of an approach based on historical institutionalism (old institutionalism, Dupuy et al., 2015; regulation theory, Zuideau, 2007)? Are they partially the result of strategic choices, as considered by proponents of rational choice institutionalism (as for New institutional economics, Paavola and Adger, 2005)? Are they fundamentally dependent on values, as for sociological institutionalism (Centemeri, 2015) or on habits, following evolutionist approaches (Hodgson, 2010)?

While deciding what option is most relevant according to the topic and context is beyond the scope of the present article, we consider that if it is to be in touch with reality and transformative, an ecological economics of water must be based on an institutional theory.

### 2.3. A mutual enrichment to further develop the theoretical and methodological toolkit of the ecological economics of water

Recent contributions published at the occasion of the 30<sup>th</sup> anniversary of the institutionalization of the ecological economics field (mobilizing both the journal and the society) have stressed the necessity to better anchor *Ecological Economics* in its historical roots and to engage a dialogue with other fields of study which have emerged during the past decades, especially in the social sciences (social ecological systems, commons, degrowth, etc.). Ecological economics, as a field of study, has traditionally been interested in engaging interdisciplinary dialogues with boundary objects and especially ‘Grand concepts’ (Lundgren, 2021) such as sustainable development, ecosystem services or resilience. In the field of water, other Grand concepts mentioned in the first section of this paper (IWRM, the nexus approaches, and more recently nature-based solutions) need to be mobilized, criticized and overcome by ecological economists. It is all the more important since, according to Wironen and Erickson (2020: 4), ‘to date, ecological economics has given less attention to the social and political as opposed to the economic and ecological.’ Indeed, these Grand concepts, which are commonly used in the political

discourse, must be carefully scrutinized and this is the reason why ecological economists also need to further develop a critical inquiry of water management issues.

Several approaches developed by social scientists can help strengthen a critical inquiry of water management issues in the field of ecological economics. Sources of inspiration can come from specific journals dealing with water management issues (*Water Alternatives* for instance) or dealing with a wide range of issues, in a critical way, such as *Geoforum*. Ecological economists should be aware of the evolution of theories, methods and ideas developed in these journals, to enrich their own work. The journal *Ecological Economics* can also become the locus of new and ground-breaking ideas, methodologies and approaches, just as exemplified in a recent paper published in the journal on rooted water collectives (Vos et al. 2020).

At the same time, ecological economists interested in water resource management should be able to develop a discussion platform to foster dialogue and controversies, between scholars and professionals dealing with water-related issues, within the field of ecological economics and beyond. Opening the theoretical and methodological waterscape can bring new ideas from the fields of political ecology (Kallis et al., 2013; Linton and Budds, 2014), transboundary water resource management and hydro-politics (Zeitoun and Warner, 2006; Zeitoun and Mirumachi, 2008), cultural political economy (Mollinga, 2019; Ioris, 2020 in this special section), or socio-hydrology (Wesselink et al. 2017; Konar et al., 2019).

This double movement - openness to what is happening outside of the field of ecological economics and ability to host controversies within the field and beyond - is, according to us, a necessary step to continue developing political and social issues in water management and thus challenging the ecological economics of water. We remain convinced that a scientific field, such as ecological economics, can only develop and diffuse ground-breaking ideas through a cross-fertilization process.

### 3. The special section ‘Ecological economics of water: social and political perspectives’: a brief overview

This special section displays common features with the two previous ones presented before. It is related to the collective nature of the issue. This special section follows the session entitled ‘Towards an Ecological Economics of Water’ the authors of the present paper organized during the ESEE 2017 conference held in Budapest. Among the papers presented there, some succeeded in being published. As this special section is far from covering all the issues (ontological, methodological, theoretical), it is much more the beginning of a discussion than the end of a research cycle. Below, we briefly sketch out the papers published under the umbrella of this special section. Our purpose is to invite the reader to have a closer look at them by stressing the main messages contained in the papers. They are presented chronologically, following their date of publication in the journal.

The first paper by Arnaud Buchs, Olivier Petit and Philippe Roman (2020) takes an introspective look at the water-related literature in ecological economics, addressing the importance of social and political dimensions and questioning the degree of pluralism in this field. On the basis of Spash’s (2013) reference typology (which identifies three groups of researchers in the field of ecological economics: ‘new resource economists’, ‘new environmental pragmatists’ and ‘social ecological economists’), the

authors focus on social ecological economics and its imprint in water research. Two methods of content analysis are developed: first, the tenets and limits of Spash's typology are examined using selected papers published in *Ecological Economics*. Then, the authors perform a textual analysis of a large corpus of articles' abstracts in the fields of i) ecological economics and ii) environmental and resource economics. The authors show that, in the field of ecological economics of water, Spash's groups are not easily distinguishable and clear-cut boundaries are difficult to find. Moreover, *Ecological Economics* appears at the interface between mainstream approaches and more critical ones. An alternative representation of the field is suggested 'in the form of a triangle where each approach constitutes a vertex, and where what distinguishes approaches in pairwise comparisons is (1) the kind of metrics used, (2) the transformative nature of science, and (3) theoretical consistency'. In order to strengthen pluralism within the field of ecological economics of water, the authors provide an overview of what a social ecological economics of water should look like: the ontological particularity of water; value pluralism, power relations; pluralistic, interdisciplinary and reflexive methodology; articulation between theory and field-work.

The second paper (Colby, 2020) focuses on the western US to analyse, from two complementary theoretical approaches (social ecological economics of water and punctuated equilibrium theory), how environmental flows in rivers and aquifers have been addressed by public policy instruments. More specifically, the paper considers the implementation of water markets and applies its analytical framework to two case studies: Edwards Aquifer in Texas and the Colorado River Delta. The analysis highlights the importance of power issues in the implementation of these water markets and emphasizes the importance of recognizing water as a common patrimony (Calvo-Mendieta et al., 2017). In addition, the paper highlights the need to design innovative public policy instruments to consider a variety of competing issues. It proposes to move away from a stigmatizing vision of water markets, sometimes criticized for dogmatic reasons, and offers avenues for the future development of this type of instrument in the western US, as well as in other places around the world.

The diversity of approaches within the 'big tent' of ecological economics may be illustrated by the paper proposed by Sahar Daghigh Yazd, Sarah Ann Wheeler and Alec Zuo (Yazd et al., 2020). Authors address political and social consequences of climate change and water scarcity through farmer's health in the Murray Darling Basin (Australia), and more particularly their effect on mental health. They model farmers' mental health by merging several databases, including the longitudinal survey 'Household, Income and Labour Dynamics in Australia' (HILDA, 14 waves from 2001 to 2015, period that includes the 'Millennium drought') and various climate and water databases. Climate change impacts the variability of rainfalls, increasing uncertainty over water allocations of farmers. The paper reveals that water scarcity increases psychological distress for Australian farmers, worsening psychological distress already induced by financial difficulties (farmer suicide rates are up to two times higher than the general population's rate). To encourage farmers' resilience to address 'hotter and drier future', the authors suggest that policies must focus on long-term, preventative approaches, rather than current short-term, reactive approaches. These policies may, for example, enhance agro-ecological practices. As livelihood is positively linked to farmer mental health, the authors suggest to secure earnings, by recognising the role of agriculture for the provision of environmental/ecological services. The paper invites to question the relevance of the current ultra-competitive agricultural production system.

loris (2020) addresses the issue of development and modernisation in the Brazilian Amazon region through hegemonic water development and dam construction. Doing so, he vindicates the usefulness of a socioecological economics of water: 'Among many positive attributes, socioecological economics can help us to understand the impact of mainstream developmental ideologies and associated discourses, as well as to comprehend the complexity of the interface between economic and more-than-economic practices.' (p. 5) loris' specific take on how socioecological economics of water could contribute to understanding water management practices is to put to the fore the ideas of resignification and cultural political economy. In his opinion, more attention should be paid to cultural dimensions, in particular the politics of identity and recognition.

The paper by Özge Can Dogmus and Jonas Østergaard Nielsen on corruption in the hydropower sector in Bosnia and Herzegovina is a good example of how approaches that fall under (integrative) geography or political ecology may address political aspects linked to water policy. As such, this article provides a way to bridge complementary approaches to ecological economics ones. The authors focus on the hydropower boom in Bosnia and Herzegovina, with a particular emphasis on small-scale hydropower plants. They show that most projects were aborted or still remain on paper, some for more than 10 years (in 2017, the number of planned hydropower projects was almost 300, 251 of which were small-scale projects, and only 19 of which were actually under construction). Endemic corruption in the sector in particular and in the country in general is one of the main reasons for this situation. Through an empirical study, the authors present the administrative structuring that encourages this corruption. While the literature on the links between hydropower and corruption in developing and transition countries is substantial, it focuses on mega projects. A blind spot remains regarding small-scale units and this paper aims at filling this gap.

The paper by Elena Lopez-Gunn et al. aims to analyse the difficulties of integrating nature-based solutions into the range of public policy instruments in the fields of water and biodiversity. Starting from the Spanish case, whose imaginary about water is strongly marked by the need to build new infrastructures to cope with resource scarcity (hydraulic paradigm), the authors examine the case of the Medina del Campo aquifer and analyse the discourses of the actors, to identify the instruments that could appear to be the most appropriate, if one aims to go beyond this hydraulic paradigm. Drawing on an institutional analysis borrowed from new institutional economics (Williamson and Ostrom in particular) and the political science work of Paul Sabatier, the authors develop an analytical grid based on several layers, allowing them to highlight the evolution of values and political frameworks. Nature-based solutions are then presented as natural assurance schemes, where the preservation of ecosystem services other than productive services appears hierarchically more important. This vision is compatible with the recognition of water as an eco-social asset, or even a common patrimony, and is thus closer to the principles of social ecological economics.

## Concluding remarks

We are convinced that the seeds for social and political approaches of water resources already exist, within and beyond the ecological economics community, and some of them make up this special section. Still, efforts remain to be made to upscale socio-politically oriented work on water topics in ecological economics and bridges remain to be built between ecological economists of water and social science, human geography and political ecology critical scholars. We argue that sharing, collectively

developing and refining institutionalist frameworks specifically devised for the understanding of water issues might play a key role in shaping a community of ecological economists seriously engaged with the social and political dimensions of water. It would bring significant scientific benefits and contribute to a more critical and transformative ecological economics of water. The special section 'Ecological Economics of Water: Social and Political Perspectives' offers alternative pathways to contribute to this vision, and we hope that more research will come to feed the debate.

## References

Abers, R.N., Keck, M.E., 2013. *Practical Authority. Agency and Institutional Change in Brazilian Water Politics*, Oxford University Press.

Ahlers, R., Zwarteveen, M., 2009. The water question in feminism: Water control and gender inequities in a neo-liberal era. *Gender, Place and Culture*, 16(4): 409–426.

Aguilera-Klink, F., Pérez-Moriana, E., Sánchez-García, J., 2000. The social construction of scarcity. The case of water in Tenerife (Canary Islands). *Ecological Economics* 34(2): 233-245.

Albrecht, T.R., Crootof, A., Scott, C.A., 2018. The Water-Energy-Food Nexus: a systematic review of methods for nexus assessment. *Environ Res Lett* 13, <https://doi.org/10.1088/1748-9326/aaa9c6>.

Allouche, J., Middleton, C., Gyawali, D., 2018. *The water-food-energy nexus. Power, politics and Justice*. London, Earthscan.

Anderson, E.P., Jackson, S., Tharme, R.E., Douglas, M., Flotemersch, J.E., Zwarteveen, M., Lokgariwar, C., Montoya, M., Wali, A., Tipa, G.T., Jardine, T.D., Olden, J.D., Cheng, L., Conallin, J., Cosens, B., Dickens, C., Garrick, D., Groenfeldt, D., Kabogo, J., Roux, D.J., Ruhi, A., Arthington, A.H. 2019. Understanding rivers and their social relations: A critical step to advance environmental water management. *WIREs Water* 6:e1381. <https://doi.org/10.1002/wat2.1381>.

Antunes, P., Kallis, G., Videira, N., Santos, R., 2009. Participation and evaluation for sustainable river basin governance. *Ecological Economics* 68(4): 931-939.

Barbier, E.B., Burgess, J.C., 2017. Natural Resource Economics, Planetary Boundaries and Strong Sustainability. *Sustainability* 9, 1858.

Baumgärtner, S., Becker, C., Frank, K., Müller, B., Quaas, M., 2008. Relating the philosophy and practice of ecological economics: The role of concepts, models, and case studies in inter- and transdisciplinary sustainability research. *Ecological Economics* 67(3): 384-393.

Becker, S., Sparks, P., 2020. "It never rains in California": Constructions of drought as a natural and social phenomenon, *Weather and Climate Extremes* 29.

Bel, G., Fageda, X., Warner, M.E., 2010. Is private production of public services cheaper than public production? A meta-regression analysis of solid waste and water services. *J. Policy Anal. Manag* 29: 553-577, doi:10.1002/pam.20509.

- Beltran, M.J., Kallis, G., 2018. How does virtual water flow in Palestine? A political ecology analysis. *Ecological Economics* 143: 17-26.
- Biermann, F., Kim, R.E., 2020. The Boundaries of the Planetary Boundary Framework: A Critical Appraisal of Approaches to Define a “Safe Operating Space” for Humanity. *Annual Review of Environment and Resources* 45(1): 497-521. doi: [10.1146/annurev-environ-012320-080337](https://doi.org/10.1146/annurev-environ-012320-080337)
- Biswas, A.K., 2004. Integrated Water Resources Management: A Reassessment. *Water International* 29(2): 248–256.
- Boelens, R., Hoogesteger, J., Swyngedouw, E., Vos, J., Wester, P., 2016. Hydrosocial territories: a political ecology perspective, *Water International*, 41(1): 1-14.
- Boelens, R., Perreault, T., Vos, J., 2018. *Water Justice*. Cambridge, Cambridge University Press.
- de Boissezon, B., 2015. European Commission (Head of Unit 'Sustainable Management of Natural Resources' – DG RTD 'Climate Action and Resource Efficiency' Directorate), Alternet-conference – Opening session Speech on 19.5.2015.
- Borderon, M., Buchs, A., Leblan, V., Vecchione, E., 2015. Réflexivité et registres d’interdisciplinarité. Une boussole pour la recherche entre natures et sociétés. *Natures Sciences Sociétés* 23(4): 399-407.
- Bridgewater, P., 2018. Whose nature? What solutions? Linking Ecohydrology to Nature-based solutions. *Ecohydrology & Hydrobiology* 18(4): 311-316.
- Brouwer, R., Hofkes, M., 2008. Integrated Hydro-economic modelling: Approaches, key issues and future research directions. *Ecological Economics* 66(1): 16-22.
- Buchs, A., 2016. *La pénurie en eau est-elle inéluctable ? Une approche institutionnaliste de l’évolution du mode d’usage de l’eau en Espagne et au Maroc*, Bruxelles, Peter Lang, coll. EcoPolis.
- Buchs, A., Petit, O., Roman, P., 2020. Can social ecological economics of water reinforce the 'Big Tent'? *Ecological Economics* 169.
- Calvo-Mendieta, I., Petit, O., Vivien, F.-D., 2017. Common Patrimony: A Concept to Analyze Collective Natural Resource Management. The Case of Water Management in France. *Ecological Economics* 137: 126-132.
- Centemeri, L., 2015. Reframing problems of incommensurability in environmental conflicts through pragmatic sociology: from value pluralism to the plurality of modes of engagement with the environment. *Environmental Values* 24: 299-320.
- Colby, B.J., 2020. Acquiring environmental flows: ecological economics of policy development in western U.S. *Ecological Economics* 173.
- Cole, D.H., Epstein, G., McGinnis, M.D., 2019. The Utility of Combining the IAD and SES Frameworks. *International Journal of the Commons* 13(1): 244-275.



Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., van den Belt, M., 1997. The value of the world's ecosystem services and natural capital. *Nature* 387: 253-260.

DiMaggio, P., 1998. The New Institutionalisms: Avenue of Collaboration, *Journal of Institutional and Theoretical Economics*, 154(4): 696-705.

Dogmus, Ö.C., Nielsen, J. Ø., 2020. The on-paper hydropower boom: A case study of corruption in the hydropower sector in Bosnia and Herzegovina. *Ecological Economics* 172 <https://doi.org/10.1016/j.ecolecon.2020.106630>

Dumont, A., Leyronas, S., Petit, O., Ballin, Q., 2021. Acting together for the Sustainable Use of Water in Agriculture. Proposals to Prevent the Deterioration and Overexploitation of Groundwaters. Agence Française de Développement, Policy Paper, n°8.

Dupuy, R., Roman, P., Mougenot, B., 2015. Analyzing Socio-Environmental Conflicts with a Commonsian Transactional Framework: Application to a Mining Conflict in Peru. *Journal of Economic Issues* 49(4): 895-921.

Faivre, N., Fritz, M., Freitas, T., de Boissezon, B., Vandewoestijne, S., 2017. Nature-based solutions in the EU: innovating with nature to address social, economic and environmental challenges. *Environ. Res.* 159: 509-518.

Garrick, D.E., Hall, J.W., Dobson, A., Damania, R., Grafton, R.Q., Hope, R., Hepburn, C., Bark, R., Boltz, F., De Stefano, L., O'Donnell, E., Matthews, N., Money, A., 2017. Valuing water for sustainable development. *Science* 358 (6366), 1003-1005. doi: 10.1126/science.aao4942

Garrick, D.E., Hanemann, M., Hepburn, C., 2020. Rethinking the economics of water: an assessment. *Oxford Review of Economic Policy* 36(1): 1-23.

Genovese, A., Pansera, M., 2020. The Circular Economy at a Crossroads: Technocratic Eco-Modernism or Convivial Technology for Social Revolution?, *Capitalism Nature Socialism*. Doi: 10.1080/10455752.2020.1763414.

Gerber, J.-D., Knoepfel, K., Nahrath, S., Varone, F., 2009. Institutional Resource Regimes: Towards sustainability through the combination of property-rights theory and policy analysis. *Ecological Economics* 68(3): 798-809.

Giampietro, M., Funtowicz, S.O., 2020. From elite folk science to the policy legend of the circular economy. *Environmental Science and Policy* 109: 64-72.

Giordano, R., Pluchinotta, I., Pagano, A., Scricciu, A., Nanu, F., 2020. Enhancing nature-based solutions acceptance through stakeholders' engagement in co-benefits identification and trade-offs analysis. *Science of The Total Environment* 713: Article 136552

Gleeson, T., Wang-Erlandsson, L., Zipper, S.C., Porkka, M., Jaramillo, F., Gerten, D., Fetzer, I., Cornell, S.E., Piemontese, L., Gordon, L.J., Rockström, J., Oki, T., Sivapalan, M., Wada, Y., Brauman, K.A., Flörke, M., Bierkens, M.F.P., Lehner, B., Keys, P., Kummu, M., Wagener, T., Dadson, S., Troy, T.J., Steffen, W.,



- Falkenmark, M., Famiglietti, J.S., 2020. The Water Planetary Boundary: Interrogation and Revision. *One Earth* 2(3): 223-234.
- Gómez Martín, E., Mániz Costa, M., Schwerdtner Mániz, K., 2020. An operationalized classification of Nature Based Solutions for water-related hazards: From theory to practice, *Ecological Economics* 167, <https://doi.org/10.1016/j.ecolecon.2019.106460>
- Graefe, O., 2011. River Basins as new Environmental Regions? The depolitization of water management. *Procedia–Social and Behavioral Sciences* 14: 24-27.
- Grafton, Q., R., Horne, J., Wheeler, S.A., 2016. On the Marketisation of Water: Evidence from the Murray-Darling Basin, Australia. *Water Resources Management* 30: 913–926. <https://doi.org/10.1007/s11269-015-1199-0>
- Gulsrud, N.M., Hertzog, K., Shears, I., 2018. Innovative urban forestry governance in Melbourne?: Investigating “green placemaking” as a nature-based solution. *Environmental Research* 16: 158-167.
- Hall, P., Taylor, R., 1996. Political Science and the Three New Institutionnalisms. *Political Studies*, XLIV: 936–957.
- Heistermann, M., 2017. A planetary boundary on freshwater use is misleading. *Hydrol. Earth Syst. Sci.*, 21: 3455–3461, <https://doi.org/10.5194/hess-21-3455-2017>
- Hodgson, G.M., 2010. Darwinian coevolution of organizations and the environment. *Ecological Economics* 69(4): 700-706.
- Ioris, A.A.R., 2020. Socioecological economics of water development in the Brazilian Amazon: Elements for a critical reflection. *Ecological Economics* 173, <https://doi.org/10.1016/j.ecolecon.2020.106654>
- Kallis, G., Gómez-Baggethun, E., Zografos, C., 2013. To value or not to value? That is not the question. *Ecological Economics* 94: 97-105.
- Kellner, E., 2021. The controversial debate on the role of water reservoirs in reducing water scarcity. *WIREs Water*.
- Konar, M., García, M., Sanderson, M.R., Yu, D., Sivapalan, M., 2019. Expanding the Scope and Foundation of Sociohydrology as the Science of Coupled Human-Water Systems. *Water Resources Research* 55(2): 874-887.
- Korhonen, J., Honkasalo, A., Seppälä, J., 2018. Circular Economy: The Concept and its Limitations. *Ecological Economics* 143: 37-46.
- Krauze, K., Wagner, I., 2019. From classical water-ecosystem theories to nature-based solutions — Contextualizing nature-based solutions for sustainable city. *Science of The Total Environment* 655: 697-706.
- Kumar, P., Debele, S.E., Sahani, J., Aragão, L., Barisani, F., Basu, B., Bucchignani, E., Charizopoulos, N., Di Sabatino, S., Domeneghetti, A., Sorolla Edo, A., Finér, L., Gallotti, G., Juch, S., Leo, L.S., Loupis, M.,

- Mickovski, S.B., Panga, D., Pavlova, I., Pilla, F., Löchner Prats, A., Renaud, F.G., Rutzinger, M., Sarkar Basu, A., Shah, M.A.R., Soini, K., Stefanopoulou, M., Toth, E., Ukonmaanaho, L., Vranic, S., Zieher, T., 2020. Towards an operationalisation of nature-based solutions for natural hazards. *Science of The Total Environment* 731:138855, <https://doi.org/10.1016/j.scitotenv.2020.138855>
- Lafortezza, R., Sanesi, G., 2019. Nature-based solutions: Settling the issue of sustainable urbanization. *Environmental Research* 17: 394-398.
- La Jeunesse, I., Larrue, C., (Eds). 2019. Facing hydrometeorological extreme events: A governance issue. Wiley.
- Lélé, S., 1991. Sustainable Development: A Critical Review. *World Development* 19(6): 607-621.
- Lin, Z., Qi, J., 2017. Hydro-dam – A nature-based solution or an ecological problem: The fate of the Tonlé Sap Lake, *Environmental Research*, 158: 24-32, <https://doi.org/10.1016/j.envres.2017.05.016>
- Linton, J., Budds, J., 2014. The Hydrosocial cycle: defining and mobilizing a relational-dialectical approach to water. *Geoforum* 57: 170-180.
- Lopez Gunn, E., Rica, M., Zorrilla-Miras, P., Vay, L., Mayor, B., Pagano, A., Altamirano, M., Giordano, R., 2021. The Natural Assurance value of nature-based solutions: a layered institutional analysis for long term climate resilient transformation. *Ecological Economics* 186, 107053.
- Lundgren, J., 2021. The Grand Concepts of Environmental Studies Boundary objects between disciplines and policymakers. *Journal of Environmental Studies and Sciences* 11: 93-100 <https://doi.org/10.1007/s13412-020-00585-x>
- Marques, R.C., Simões, P., 2020. Revisiting the Comparison of Public and Private Water Service Provision: An Empirical Study in Portugal. *Water* 12(5): 1477.
- McDonald, D.A., Swyngedouw, E., 2019. The New Water Wars: Struggles for Remunicipalisation. *Water Alternatives* 12(2): 322-333.
- Medema, W., McIntosh, B.S., Jeffrey, P.J., 2008. From premise to practice: a critical assessment of integrated water resources management and adaptive management approaches in the water sector. *Ecology and Society* 13(2): 29. [online] URL: <http://www.ecologyandsociety.org/vol13/iss2/art29/>
- Meinzen-Dick, R., 2007. Beyond panaceas in water institutions, *PNAS*, September 25, 104(39): 15200-15205, <https://doi.org/10.1073/pnas.0702296104>.
- Merrey, D.J., Drechsel, P., Penning de Vries, F.W.T., Sally, H., 2005. Integrating “livelihoods” into integrated water resources management: taking the integration paradigm to its logical next step for developing countries. *Reg Environ Change* 5: 197–204, doi 10.1007/s10113-004-0088-5.
- Molle, F., Mollinga, P.P., 2003. Water Poverty Indicators: Conceptual Problems and Policy Issues. *Water Policy* 5(5): 529-544.

- Mollinga, P.P., 2019. Cultural Political Economy and critical water studies: An introduction to the special themed section. *Water Alternatives* 12(3): 788-801.
- Mollinga, P.P., 2020. Knowledge, context and problemsheds: a critical realist method interdisciplinary water studies, *Water International*, 45(5): 388-415, doi: 10.1080/02508060.2020.1787617.
- Muller, M., 2015. The 'nexus' as a step back towards a more coherent water resource management paradigm. *Water Alternatives* 8(1): 675-694.
- Myrdal, G., 1978. Institutional Economics. *Journal of Economic Issues* 12(4): 771-783.
- Nielsen, K., 2001. Institutional Approaches in the Social Sciences: Typology, Dialogue, and Future Challenges. *Journal of Economic Issues* 35(2): 505–516.
- Nika, C.E., Gusmaroli, L., Ghafourian, M., Atanasova, N., Buttiglieri, G., Katsou, E., 2020. Nature-based solutions as enablers of circularity in water systems: A review on assessment methodologies, tools and indicators, *Water Research* 183, 115988, <https://doi.org/10.1016/j.watres.2020.115988>
- Norman, E.S., Cook, C. Cohen, A., (Eds.), 2015. *Negotiating Water Governance: Why the Politics of Scale Matters in the Governance of Water?* Farnham, UK: Ashgate.
- Paavola, J., 2002. Water Quality as Property: Industrial Water Pollution and Common Law in the Nineteenth Century United States. *Environment and History* 8(3): 295-318.
- Paavola, J., Adger, W.N., 2005. Institutional Ecological Economics. *Ecological Economics* 53(3): 353-368.
- Pahl-Wostl, C., 2009. A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change* 19: 354–365.
- Petit O., Baron, C., 2009. Integrated Water Resources Management: From General Principles to its Implementation by the State. The case of Burkina Faso. *Natural Resources Forum* 33(1): 49-59.
- Pickering, J., Persson, Å., 2020. Democratising planetary boundaries: experts, social values and deliberative risk evaluation in Earth system governance. *Journal of Environmental Policy & Planning* 22(1): 59-71.
- Poupeau, F., Coeurdray, M., Cortinas, J., O'Neill, B., 2016. The making of water policy in the American southwest: Environmental sociology and its tools. In Poupeau, F., Gupta, H., Serrat-Capdevila, A., Sans-Fuentes, M. A., Harris, S., Hayde, L. (Eds.). *Water bankruptcy in the land of plenty* (p. 101–118). Leiden: CRC Press.
- Raworth, K., 2017. *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*. Random House Business.
- Rockström, J., Steffen, W., Noone, K., Persson, A. A., Chapin, F. S., III, et al., 2009. A safe operating space for humanity. *Nature* 461: 472–475.
- Rogers, P., de Silva, R., Bhatia, R., 2002. Water is an economic good: How to use prices to promote equity, efficiency, and sustainability. *Water Policy* 4:1-17.

- Salman, S.M.A., McInerney-Lankford, S., 2004. *The Human Right to Water: Legal and Policy Dimensions*. Washington, DC: World Bank.
- Sartal, A., Ozcelik, N., Rodríguez, M., 2020. Bringing the circular economy closer to small and medium enterprises: Improving water circularity without damaging plant productivity. *Journal of Cleaner Production* 256, 120363.
- Seddon, N., Chausson, A., Berry, P., Girardin, C.A.J., Smith, A., Turner, B., 2020a. Understanding the value and limits of nature-based solutions to climate change and other global challenges, *Phil. Trans. R. Soc.* B375: 20190120. <http://dx.doi.org/10.1098/rstb.2019.0120>
- Seddon, N., Daniels, E., Davis, R., Chausson, A., Harris, R., Hou-Jones, X., Huq, S., Kapos, V., Mace, G.M., Raza Rizvi, A., Reid, H., Roe, D., Turner B., Wicander, S., 2020b. Global recognition of the importance of nature-based solutions to the impacts of climate change. *Global Sustainability* 3, E15, <https://doi.org/10.1017/sus.2020.8>.
- Seddon, N., Turner, B., Berry, P., Chausson, A., Girardin, G.A.J. , 2019. Grounding nature-based climate solutions in sound biodiversity science. *Nature Clim Change* 9: 84–87, <https://doi.org/10.1038/s41558-019-0405-0>
- Spash, C.L., 2013. The shallow or the deep ecological economics movement? *Ecological Economics* 93: 351-362.
- Tortajada, C., Biswas, A., 2017. The rapidly changing global water management landscape. *International Journal of Water Resources Development* 33(6): 849-852.
- United Nations Water, 2018, UN World Water Development Report. Nature based solutions for water, 141 p.
- United Nations Water, 2020, UN World Water Development Report. Water and climate change, 235 p.
- Vatn, A., 2016. *Environmental Governance. Institutions, Policies and Actions*. Edward Elgar, Cheltenham.
- Vatn, A., 2020. Institutions for sustainability—Towards an expanded research program for ecological economics. *Ecological Economics* 168, 106507, <https://doi.org/10.1016/j.ecolecon.2019.106507>.
- Villamayor-Tomas, S., 2018. Polycentricity in the water-energy nexus: A comparison of polycentric governance traits and implications for adaptive capacity of water user associations in Spain. *Environmental Policy and Governance*, 28(4): 252–268.
- Vos, J., Boelens, R., Venot, J.P., Kuper, M., 2020. Rooted Water Collectives. Towards an Analytical Framework. *Ecological Economics* 173, 106651, <https://doi.org/10.1016/j.ecolecon.2020.106651>.
- Waterbury, J., 1997, Between unilateralism and comprehensive accords: Modest steps toward cooperation in international river basins, *Water Resources Development* 13(3): 279-289.
- Wesselink, A., Kooy, M., Warner, J., 2017. Socio-hydrology and hydrosocial analysis: Toward dialogues across disciplines. *WIREs Water* 4: e1196, <https://doi.org/10.1002/wat2.1196>

Wironen, M.B., Erickson, J.D., 2020. A critically modern ecological economics for the Anthropocene. *The Anthropocene Review* 7(1): 62-76.

World Economic Forum, 2015. Global Risks 2015, 10th Edition, Insight Report, 66 p., [http://www3.weforum.org/docs/WEF Global Risks 2015 Report15.pdf](http://www3.weforum.org/docs/WEF_Global_Risks_2015_Report15.pdf)

Yazd, S.D., Wheeler, S.A., Zuo, A., 2020. Understanding the impacts of water scarcity and socio-economic demographics on farmer mental health in the Murray-Darling Basin. *Ecological Economics* 169 <https://doi.org/10.1016/j.ecolecon.2019.106564>

Zeitoun, M., Mirumachi, N., 2008. Transboundary water interaction I: Reconsidering conflict and cooperation. *International Environmental Agreements* 8: 297–316.

Zeitoun, M., Warner, J. 2006. Hydro-hegemony: A framework for analysis of transboundary water conflicts. *Water Policy* 8(5): 435–460.

Zipper, S. C., Jaramillo, F., Wang-Erlandsson, L., Cornell, S. E., Gleeson, T., Porkka, M., Häyhä T., Crépin, A.S., Fetzer, I., Gerten, D., Hoff, H., Matthews, N., Ricaurte-Villota, C., Kummu, M., Wada, Y., Gordon, L., 2020. Integrating the Water Planetary Boundary With Water Management From Local to Global Scales, *Earth's Future* 8(2), <https://doi.org/10.1029/2019EF001377>

Zuindeau, B., 2007. *Régulation* School and environment: Theoretical proposals and avenues of research. *Ecological Economics* 62(2): 281-290.