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Review

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Abstract

This article gives an overview of the global water law research and provides a contemporary understanding of water law spanning across public and private law questions of natural resources use, environmental protection, and water-related disasters. The overview is based on a systematic literature review. Using HLA Hart's distinction, we divide the various strands of water law scholarship into two main perspectives, namely the internal and the external. From the law's internal perspective, water law research is conducted with an intent to interpret and clarify rights and obligations in existing legal instruments, such as multilateral agreements and national statutes, and case law. Based on the literature review, vibrant themes from this perspective are water use and protection, water cooperation, human right to water, rights of nature, water security, water services, and coherence between legal instruments and institutions. From law's external perspective, the focus of water law research is to analyse and understand how law as an instrument and societal institution facilitates and steers, but also impedes, the movement of public and private actors toward certain societal goals effectively and legitimately. Here, themes such as water law in collaborative and adaptive governance, ecosystem approach, good governance, and climate change adaptation are central.

Impact statement

Water law contains a rich body of regulation and research of key importance for tackling many of the most pressing questions related to the impacts of climate change, biodiversity loss mitigation, environmental pollution, and human rights. Yet, the current water law scholarship lacks a clear definition of water law which would bridge perspectives ranging from water resource rights to environmental protection and disaster management. Moreover, water law scholarship is typically not clear on whether the law as the object of analysis is approached from the perspective of trying to interpret and systematise existing water-related regulation (internal perspective to law), or whether there is an intent to critically analyse and propose changes or alternatives to the current regulation to achieve certain environmental, economic, or social goals (external perspective to law). This lack of clarity can be a major hurdle to scientific and societal collaboration across sectors. This article seeks to provide clarity in hopes of increasing interdisciplinary collaboration within the legal discipline as well as between legal, social scientific, humanistic, and natural scientific water scholars to help answer the water-related global challenges facing the global community.

Introduction

This article provides an overview and takes stock of the state of the art of water law as a regulatory topic and as an academic discipline. The work is motivated by the lack of a clear definition of water law as the boundaries of the field are increasingly expanding with concerns over the sufficiency and quality of Earth's freshwater resources, and their connections to climate and biodiversity loss (Steffen et al., 2015), disaster regulation (Farber, 2011), and human rights (Salman and McInerney-Lankford, 2004). Moreover, it is not always clear whether water law is approached from a strictly legal perspective to clarify the rights and obligations emanating from existing law (*de lege lata*), or whether water law is scrutinised from a policy perspective (*de lege ferenda*) to improve on the law from a particular perspective. With such stock-taking, we hope to facilitate the interdisciplinary collaboration between various fields of law, as well as between law and other fields of social, humanistic, and natural sciences. Within the confinements of space, this article does not, however, analyse in detail the robustness of the existing water law discussions.

Water law is defined broadly as the law that applies to freshwaters and their resources (Boisson de Chazournes et al., 2013, p. 7). With such wide scope, water law directly or indirectly regulates a multitude of societal sectors, such as drinking water production, agricultural irrigation, hydropower generation, mining and other industrial waste-water treatment, and navigation (Boisson de Chazournes et al., 2013, p. 7; Cullet, 2018, p. 329). In recent decades, water law has also come to include the

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protection of aquatic ecology (Boisson de Chazournes *et al.*, 2013, p. 7) coexisting with the environmental law of waters (Cullet, 2018, p. 329). Moreover, water law regulates how societies organize their water services and utilities and protect themselves from water-related societal disruptions, such as floods and droughts (Hartmann and Albrecht, 2014). Consequently, water law cuts across societal systems at multiple levels (international, regional, national, local) and across several sectors of society (food, energy, infrastructure, cities).

Water law has a long history as codifications such as the Code of Hammurabi (1700 Before the Common Era) contained rules on the sharing of water resources (e.g., Cech, 2010, pp. 9–14) followed by classical Roman law that regulated the use of waters in much of current Europe both before and after the beginning of the Common Era (Hollo, 2017, p. 5). Much of the history of water law is that of private law, i.e., managing water resources with contracts, property rights, torts, and the concept of nuisance (Hollo, 2017, pp. 4–5). Despite some evidence to the contrary, in many parts of the global north, public law concerning the use and protection of freshwaters developed from the early 1800th century onward as states increasingly faced competition over scarce water resources and private law remedies alone were deemed insufficient to tackle the water-related societal challenges at scale (Boisson de Chazournes *et al.*, 2013, p. 7; Hollo, 2017, pp. 3–4). These initially national developments also lead to the establishment of bi- and multi-lateral as well as international water law which gradually formed the multilevel and multisector system of water law in place today (Hollo, 2017, p. 9).

Conventional water laws have only regulated surface freshwater resources and groundwater, while saline waters have been regulated by the law of the sea and marine environmental law. In contemporary water law, however, this division has started to blur (Hollo, 2017, p. 10). While still maintaining the core division of labour between fresh and saline waters, for instance, the European Union (EU) Water Framework Directive (2000/60/EC) regulates freshwaters, but also transitional and coastal waters. Similarly, the EU Marine Strategy Framework Directive (2008/56/EC), while applying to marine waters, recognises that the management of freshwaters and the adjacent land use are key to realising the effective protection of marine environmental quality particularly with challenges such as the agricultural nutrient runoff and plastic pollution (Arnold, 2014, pp. 1046–1047; McIntyre, 2022, p. 221). In this way, questions of water law have become more prominent in marine environmental law, and vice versa, recognising the land-sea continuum shaping the aquatic ecosystems.

Methodologically, this review article is based on a systemic literature review complemented by expert judgment. The literature review covered two searches on the Web of Science and Google Scholar databases respectively, with “Water law” and “Water Rights” as keywords, focusing on publications in legal academic outlets in the past five years (1.1.2018–31.12.2022). In some sections, the search terms were broadened to include more specific terminology if the generic terms did not yield results. For instance, in water services and utilities section terms “Water services and law” were used, and rights of nature section was complemented by “rights of the river” searches. The choice of search terms and databases do leave out a significant portion of particularly national scholarship with a purely legal focus. Acknowledging these limitations, the materials were also complemented by the inclusion of handbooks and research articles falling outside the searches. This provided us with background information to check and complement our pre-existing expertise on the key categories and themes of water law.

After the searches and gathering of material, the material was divided into several categories. The first division of categories is between internal and external perspective to law, which is based on HLA Hart’s (1961) widely applied understanding of the concept of law. Roughly put, internal perspective to law means asking questions about what the law requires from different actors using the legal doctrinal method. In contrast, external perspective to law means using empirical methods, such as interviews and statistical analysis to answer questions pertaining to, for instance, the effectiveness or legitimacy of law as part of policy instrument mixes geared to achieve certain societal ends. Such division between the internal and external perspectives helps clarify the theoretical and methodological starting points of water law research (see also Soininen *et al.*, 2023a). The sub-categories under these two broad banners were then divided further in terms of the substance of the articles encountered by relying on grounded theory. In practice, this means inductive categorisation of the studied material based on the material itself (Charmaz, 2014, p. 1).

The article is structured as follows. In Section “Internal legal perspective to water law: establishing what the law requires”, we focus on the various themes of water law from law’s internal perspective. Internal perspective focuses on what kind of rights and obligations water law at various levels of governance (international, regional, national) establishes for public and private actors. Section “External perspectives: effectiveness and legitimacy of water law” focuses on an external perspective to law, in other words, societal legal scholarship on whether and how water law contributes to implementing water-related societal goals and aspirations. Section “Synthesis and future perspectives” synthesises and provides a brief outlook on the future of water law.

Internal legal perspective to water law: Establishing what the law requires

In this section, our focus is on scholarship that explores water law from an internal legal perspective, with the intent to interpret and *clarify rights and obligations* in existing legal instruments, such as multilateral agreements and national statutes, and case law related to them. This perspective also contains efforts to systematise and make the rights and obligations concerning waters at various levels and branches of law *coherent*, in other words, that the goals, rights, and obligations established in one legal instrument would not undermine obligations established in other instruments. Both the interpretive and systematising strands in legal scholarship are often coupled with a desire to improve on the legal instrumentation and help it reach societal goals effectively. Such desire is visible, for instance, in balancing the expectation of predictability and permanence that water laws should ideally provide and need for laws to be flexible to cope with social-ecological change and scientific risk and uncertainty (McCaffrey *et al.*, 2019b, p. 1). Nonetheless, more general (and often interdisciplinary) perspectives are left in the background and the interpretive and systematising legal scholarship is meant to primarily serve authorities and courts in implementing and enforcing water law, or signal to the legislature (or treaty organisation) that there is vagueness and gaps in, or contradictions between, legal instruments that would merit legislative changes.

Water use and protection

Water use and protection are classical themes of water law. At the international level, they are manifested in the 1997 UN

Watercourses Convention in the form of the principle of reasonable and equitable utilization and the no-harm rule that are interrelated (McCaffrey, 2019; Schmeier and Gupta, 2020; Tanzi, 2020). According to the Watercourses Convention, states must aim to attain optimal and sustainable utilization of and benefits from international waters, while being consistent with adequate protection of these waters (art. 5). Water uses include a variety of uses, such as agricultural uses and drinking water and hydroelectricity generation. The Convention states that no water use enjoys inherent priority over other uses and all relevant factors must be considered in decision-making (arts. 6 and 10) (see McCaffrey, 2019). Regarding water protection, states must take all appropriate measures to prevent causing significant harm to each other, protect and preserve the ecosystems and prevent, reduce, and control water pollution (arts. 7 and 20-21) (see McIntyre, 2019).

Water use and protection are often approached through a basin-specific or regional case study addressing the different levels (international, regional, national) of water law (see McCaffrey et al., 2019a). Also, legal comparison between countries or regions is common (Burchi, 2019; Macpherson, 2022) as well as analysing the relationship between the legal rules of water use and water protection (Tanzi, 2020). In recent years, water use has been discussed, for example, in relation to the principles of international water law (Meshel, 2020), priority between different uses (Zheng and Spijkers, 2021), benefit-sharing (Fatch et al., 2022), property and water rights (Bosch and Gupta, 2022), human right to water (Hildering, 2020), climate change adaptation (Bigelow and Zhang, 2018), hydropower energy and dams (Meshel, 2020; Puharinen, 2022), water markets (Womble et al., 2022), circular economy (Di Marco, 2022) and water-energy-food-ecosystems nexus (Belinskij et al., 2020). Also, groundwater use has gained prominence in water law publications (Milanés-Murcia, 2019; Viljoen, 2020; Cuadrado-Quesada and Joy, 2021). The UNECE has published a Handbook on Water Allocation in a Transboundary Context under the 1992 Water Convention (UNECE, 2021) and water allocation has been discussed in research to some extent (Larson and Tarlock, 2019; Mahmoudzadeh Varzi et al., 2019).

Legal research on water protection has increasingly highlighted an ecosystem approach (McIntyre, 2019) related to the no-harm rule (Schmeier and Gupta, 2020) and other provisions of water law. In some publications the relationship between water law and the broader environmental law has been analysed (Ashton and Aydos, 2019; Nelson, 2019). Moreover, water law research has addressed water pollution (McIntyre, 2022), normative incoherence (Liu, 2020), ecosystem services (Ruhl, 2018) and transboundary impacts (Xie and Ibrahim, 2021). In addition to water pollution, research has highlighted water quality aspects, and, at the European level, a substantial number of publications have focused on the environmental objectives of the Water Framework Directive and their implementation in the EU Member States (Söderasp and Pettersson, 2019; Starke and van Rijswijk, 2021).

Water cooperation

The need for water cooperation is highlighted at the different levels of water law. In international water law, cooperation between states has been addressed through the general duty to cooperate, Leb, 2019), prior notice to other states (Cafilisch, 2019), the principle of reciprocity in cooperation between states (Devlaeminck, 2019) as well as numerous case-study examples including bi- and multilateral water agreements and joint bodies such as international water commissions (see McCaffrey, 2019). The legal themes addressed

also include reporting under international water law (Rieu-Clarke, 2020), negotiations between states and water diplomacy (Schmeier, 2021), resolution of water disputes (Meshel, 2020) and international river basin organizations (Schmeier and Shubber, 2018). Moreover, bi- and multilateral water agreements have been subject to legal reviews (Zhao et al., 2022). Within EU water law, transboundary cooperation (Reichert, 2016) as well as public participation in river basin planning have been addressed (Rimmert et al., 2020).

Human right to water

The UN General Assembly recognized the right to safe and clean drinking water and sanitation as a human right in its Resolution (64/292) in 2010. The right to water has been included in some national constitutions as well and it has invited lively discussion in water law research (Winkler, 2019; Ahmad and Lilienthal, 2021). The relationship between the human right to water and international water law has been addressed in many recent publications (Russell, 2019; Hildering, 2020; Spijkers, 2020a). At the European level, the European Citizen's initiative on water and sanitation as a human right has been a subject of academic interest (van den Berge et al., 2020). At the national level, many legal scholars have analysed the implementation of the right to water (Kowalski, 2020; Obani, 2020) and the related investment disputes (Chen, 2020; Nemeth, 2022) and legal mobilization (Van den Berge et al., 2021). The right to water has also been discussed within the context of indigenous water rights and other vulnerable populations (Viveros-Uehara, 2022).

Water services and utilities

Water supply and sanitation services (sewage disposal and wastewater treatment) have been a rising focus area in recent water law research. Water services are closely linked to the human right to water (Maphela and Cloete, 2020; van den Berge et al., 2020) and the UNECE Protocol on Water and Health aims to specifically enhance these services (art. 6) and to prevent, control and reduce water-related diseases (art. 1) (Tanzi and Farnelli, 2019). Wastewater treatment services contribute to water protection and to the management of emerging pollutants such as nanomaterials and pharmaceuticals (McIntyre, 2022; Miettinen and Khan, 2022).

In recent years, water, and sanitation services tariffs (Neto and Camkin, 2020; Pérez, 2020), the recovery of costs (Sereno, 2022) and, in general, the interplay between the quality of and economic costs of such services (Cabrera et al., 2022) have been widely discussed. Moreover, the legal regulation of the pricing system for water services has been linked with the principles of cost recovery and polluter pays (Sobota, 2022) and with the balancing between environmental, economic, and social interests (Karageorgou and Pouikli, 2019). It has also been noted that the regulation of water and sanitation services may contribute to circular economy transition through water treatment and reuse (Di Marco, 2022). In addition, the privatization of water services (Albalate et al., 2022; McDonald, 2022) as well as water services disputes (Qian, 2020) have been approached from a legal perspective.

Rights of nature

One of the emerging approaches to improve legal instrumentalization of water law in addressing the complex set of pressures impacting water resources has been the Rights of Nature (RoN) movement, that is, the use of legal personhood and granting of legal rights to water bodies, such as rivers (Cano Pecharroman, 2018;

O'Donnell and Talbot-Jones, 2018; Kurki, 2022). These ideas are not new (see Salmond, 1947; Stone, 1972; O'Donnell and Talbot-Jones, 2018), yet while they first drifted to the fringes of environmental law, they have resurfaced in the legal academic research as well as in practise in legal systems around the world (O'Donnell, 2018, 2020; O'Donnell and Talbot-Jones, 2018). Notably, there are various examples available around the world of RoN being constitutionally recognised (e.g., Ecuador, see Kauffman and Martin, 2023) or rivers being given legal rights as persons through judicial decisions (e.g., Whanganui River in New Zealand, see O'Donnell and Talbot-Jones, 2018).

Typically, the basis for the legal personhood of rivers is derived either from indigenous worldviews and laws (Ruru, 2018; RiverOfLife et al., 2020; Hurlbert, 2022), or from arguing an expansion of a property rights system to include self-determinacy of the river accompanied with a guardianship or stewardship (Talbot-Jones and Bennett, 2019), which also entails strengthening the authority of local communities and indigenous peoples (Bignall et al., 2016). The rights of the rivers approach can be conceptualised as a shift from the prevailing environmental law's position of protecting the environment as a public good or for the fulfilment of human rights towards recognising the rivers' intrinsic value in the legal system and enabling it to seek legal redress on their own behalf (O'Donnell and Talbot-Jones, 2018). More specifically, recognising nature, or its specific part such as a river, as a legal person involves affording it a basic set of legal rights, including legal standing, the right to enter and enforce legal contracts, and the right to own property (Naffine, 2009; O'Donnell and Talbot-Jones, 2018). However, it is still unclear whether and how such legal recognition could lead to a higher level of environmental protection. Furthermore, it has been argued that legal personhood could actually not effectively be extended to natural entities, but rather, such legal recognition serves merely legal fictions with only symbolic value (Kurki, 2022).

Water security

Water security can be described as a lens through which to analyse questions of water allocation and protection in contexts that threaten the security of individuals or states (Lankford et al., 2013, p. ix). While inviting various interpretations, water security is typically used to denote that water may invite armed and other conflicts, but also that such conflicts affect the availability and quality of water (Pertile and Faccio, 2020; Cullet et al., 2021). Moreover, water security invites "softer" readings of security, referring not to armed conflicts and the like, but to questions of access to water, sufficient water quality, or protecting communities from floods and droughts (Brunnée and Toope, 1997; Cullet et al., 2021). Security emphasis is used both to highlight the linkages between water law and areas of law, such as human rights law, criminal law, and law of armed conflict, but also to underscore the societal importance of the topic as questions of security are typically high on any public policy agenda (Magsig, 2011, 2017, 2020). Conventionally, international and regional legal discussion on water security has leaned more toward water in armed conflict (Pertile and Faccio, 2020; Cullet et al., 2021), while national and sub-national discussions (focusing more on local communities and individuals) have revolved more around questions of securing a sufficient level of water quantity and quality and protecting communities from floods and droughts (Cullet et al., 2021). Increasingly, such perspectives are connected to the vulnerability of communities and people facing water-related disasters (Vink and Takeuchi, 2013).

Coherence between levels and fields of law

The systematic approaches to water law typically discuss the coherence (i.e., convergence, compatibility), or lack thereof (i.e., fragmentation; pluralisation) of legal instruments. Such analyses may deal with vertical coherence between various levels of water law, for instance between the global water treaties and the regional legal instruments (Louka, 2008), or between the regional and national law (Krzyk and Drev, 2021). Another perspective to coherence is horizontal, referring to the relationship between various instruments in the same field of law, such as water law (Tanzi, 2015), or between various fields of law, such as water law in relation to environmental law (Barstow Magraw and Udomritthiruj, 2019), climate law (Tarlock, 2019), trade law (Barstow Magraw and Padmanabhan, 2019), and humanitarian law (Tignino, 2019; Spijkers, 2020b; Nemeth, 2022). While the horizontality of international water law has mostly focused on the said four fields, at the national level perhaps the constitutional dimensions have been most prevalent (Puharinen, 2022; Viljoen, 2022). Strands of this literature are also developing more ambitious methods of how coherence questions can be approached (Puharinen, 2022).

External perspectives: Effectiveness and legitimacy of water law

This section focuses on water law scholarship that takes an external perspective to law. This means that law is understood as only one (albeit important) societal institution that facilitates and steers, but also impedes, the movement of public and private actors toward certain societal goals (Fisher, 2010, p. 1). The external perspective typically seeks to help legislature or treaty organisation to effectively reach its goals in the water sector, and to secure the legitimacy of such efforts (Tignino and Bréthaut, 2018, pp. xix–xx). There are two main differences to the internal perspective. First, the external perspective not only contextualises a legal analysis (e.g., international water agreements in the context of water security) by using societal framings but seeks to integrate legal analysis more closely with interdisciplinary discussions concerning the effectiveness and legitimacy of water governance. Second, such perspectives to law in governance typically also invite a more pluralistic methodological orientation (e.g., quantitative and qualitative empirical methods) compared to the internal perspective.

Water law in integrated, collaborative, and adaptive governance

One of the core themes of water governance scholarship is how to effectively reach the societal sustainability (e.g., good quality) and resilience (e.g., flood protection) goals concerning water, and what roles do the legal institutions and instruments play in this (Wuijts et al., 2018). Some of the discussions around this are explicitly asked under the rubric of Sustainable Development Goals while others ask similar questions without explicit links to the SDGs (e.g., Spijkers, 2016; Spijkers 2020a). Conventionally, much of the discussion has been about how public authorities should manage water uses, quality, and security, and how this management should be governed by law. In the context of Integrated Water Resources Management, for instance, legal questions are typically related to the connections or lack thereof between different fields of law (Kidd and Feris, 2014), or how aspirations in one policy domain (e.g., wetlands conservation) may be thwarted by misaligned incentives and water use rights (King et al., 2021). In this context, questions of how to provide effective governance responses to cumulative human pressures on

water quality (e.g., point source and diffuse emissions) are still very much alive (Nelson, 2019; Rosencranz et al., 2021).

Alongside the discussion on governance integration, there is increasing discussion on the need for public and private actors to collaborate on establishing shared policies and management frameworks for water. This is typically referred to as co-management or co-governance of water resources, and law may have several impeding and facilitating roles in promoting collaboration (Fisher and Parsons, 2020). Building on the collaborative governance theme, also questions of adaptive governance have drawn considerable attention, in other words, how can governance and law cope with social-ecological complexity and uncertainty (e.g., a local community facing drought but with legally established and rigid water allocation system; or a bilateral treaty organisation having to deal with exceptional floods in the context of legally established river flow regimes) (Cosens et al., 2015; Dunham et al., 2018; Söderasp, 2018).

Water law in an ecosystem approach to water

Ecosystem approach is a natural resources management model that has gained legal prominence in the environmental law scholarship particularly after it was endorsed under the Convention on Biological Diversity (COP 5 Decision V/6 adopted 22 May 1992). At its core, the ecosystem approach entails an integrated and adaptive approach to natural resources management and environmental protection that takes a holistic perspective on the ecosystem, and human activities as parts of it (Bohman, 2017, p. 6). Furthermore, the approach entails that ecosystems should be governed along their natural boundaries instead of administrative borders (Bohman, 2018, p. 92). It has been argued that ecosystem approach is needed for effective management and governance of waters (Louka, 2008).

In keeping with the ecosystem approach, several water law regimes on international, EU and national level base their aims on the environmental quality of water ecosystems and build their regulatory structure on holistic assessments and compilation of legal measures that are deemed the most effective in each ecosystem's context (Bohman, 2017, 2018).

For these reasons, ecosystem approach has emerged and persisted as a prominent theme in water law scholarship, where research has particularly oriented towards the questions on how well current water laws are aligned with the approach (Bohman, 2017, 2018) and how its operationalisation could be strengthened in water law regimes (Platjouw, 2016). On the one hand, particularly the traditional sector-specific approaches in law have been found to pose challenges for the instrumental implementation of the ecosystem approach as the latter requires a holistic approach to resource management (Xie and Ibrahim, 2021). On the other hand, integrating the ecosystem approach into legal regulation has been argued to improve the water law's effectiveness in achieving its goals, and promoting its adaptive capacity and resilience in ensuring sustainable management and use of aquatic resources (Soininen and Platjouw, 2018), which has spurred calls for water law to meet the ecological realities of the water systems it aims to govern (Ruhl, 2018; Macpherson and Weber Salazar, 2020). Consequently, the shift towards an ecosystem approach has also emphasised the role of natural scientific data and assessment as a source of normative content in water law regimes (Paloniitty and Kotamäki, 2021; Thorén et al., 2021; Soininen et al., 2023b).

Water law and legitimacy

Legitimacy typically refers to governance and law being acceptable according to some theoretical criteria, such as predictability, or that

governance is perceived as acceptable by citizens (Soininen et al., 2023b). These questions in turn may evoke questions of whether governance distributes benefits and trade-offs related to water in an acceptable way, whether there are mechanisms for correcting past wrongdoing, and whether the governance processes are equitable (Miller, 2021). All three strands of legitimacy scholarship are present in the water governance and law literature. In the retributive strand, for instance, questions of reallocating water rights after abusive regimes have been discussed (van Koppen et al., 2021). In the distributive strand, much of the discussion is about how to divide the benefits and harm related to water in an acceptable way (see Section "Internal legal perspective to water law: establishing what the law requires" on water allocation). In the procedural strand, especially participatory rights and community engagement in water management and governance processes has drawn considerable attention (Godden and Ison, 2019).

Water law and climate change

Climate change is inherently intertwined with water law; as climate change alters the Earth's hydrological regimes, its impacts will for a great part be realised through water. In legal academic scholarship, the issue of climate change and water law is on the one hand addressed from a perspective where water law is regarded as a crucial policy instrument in protecting the human societies from the adverse impacts of climate change and in shaping and enabling the societies' climate change mitigation and adaptation responses (Arnold and Gunderson, 2013). On the other hand, climate change has invited new reflections in water law scholarship to assess the capacity of the current laws to deal with the inevitable change brought upon by the changing climate (Craig, 2020). This is based on the notion that climate change poses a challenge to water law's policy objectives, rules, and procedures (Wilby et al., 2006; Craig, 2020), which calls for resilience and adaptive capacity of water law for it to stay relevant and effective in the changing social-ecological conditions (McIntyre, 2017; Puharinen, 2021). In legal scholarship, this has meant looking at water law through the lens of climate change to identify shortcomings (Keessen and van Rijswijk, 2012), untapped capacities for resilience (Garmestani et al., 2019; Puharinen, 2021) and improvements that can be made to the legal regimes to better deal with the growing challenge (Gupta and Conti, 2017). Climate change has also increased the importance of assessing the legal frameworks from the viewpoint of promoting water-related mitigation measures such as energy generation from offshore wind power and hydropower facilities (Similä et al., 2022) and adaptation measures, such as allocation of scarcer water resources (Bigelow and Zhang, 2018; Michalak, 2020) and flood protection (Kapović Solomun et al., 2022).

Synthesis and future perspectives

Based on our review, both the internal (interpretation and systematization of water laws) and external (role of water law in addressing social-ecological challenges) perspectives to water law are actively used and invite vibrant discussions. The division helps recognise the somewhat differing theoretical and methodological points of departure in water law research. From an internal perspective, particularly the questions of human right to water as well as coherence between water law and other branches of law (e.g., trade law) have been vibrant in recent years, while also conventional questions of water use and protection remain subjects of active discussion. Overall, there is an increasing trend to consider both the

private and public law aspects of water in tandem. From an external perspective, thematic questions focusing on climate change adaptation and law's role in managing water-related pressures have been strong. Both the internal and external perspectives have highlighted ecosystem approach to water in the recent years.

In the future, there is likely a need to broaden the current global water law research to cover in more depth questions like whether and how public and private actors may govern the global circulation of water from evaporation and rainfall to virtual water and global value chains (Boisson de Chazournes et al., 2013, pp. 22–23). Some research lines are already emerging, but the theme is likely to grow stronger as climate change brings about a global reallocation of water. Another broader theme likely to rise in the future is the role of water and water law in addressing the triple planetary crises related to climate change, loss of biodiversity, and environmental degradation (Steffen et al., 2015). While water has been somewhat dormant under the three broad themes, it has considerable potential as an element of scholarly and governance integration when addressing the three crises in tandem. Third, emerging pollutants, such as microplastics, are likely to draw increasing research interest from a water law perspective going forward.

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