



# Governing water in federal river basins

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Managing freshwater resources across political borders presents a fundamental challenge for regional environmental governance. The misalignment between river basin boundaries and political borders contributes to intense disputes over water resource allocation between neighbouring jurisdictions. In federal political systems, disputes over water may be exploited by politicians to secure electoral gains or pursue constitutional changes. In devolved or decentralised political systems, water often is a source of dispute, and water politics can become a reflection of the wider political dynamics (Moore 2018). Rapid social, economic and environmental change presents ‘stress tests’ in such settings, illustrating how politics, institutions and governance matter. This special issue examines water governance across political borders in federal countries.

Democratisation after the Second World War spread federal political systems to almost all democracies with large populations and extensive territory. Federal political systems distribute authority between national and subnational governments. Water governance in federations involves important roles for both national governments and subnational jurisdictions,<sup>1</sup> often granting considerable autonomy to the latter (Moore 2018). At the same time, political jurisdictions are connected by the water cycle, particularly in shared river basins, which

means that riparian states are affected by actions upstream and downstream. Disputes and coordination challenges between states are analogous to those confronted by sovereign countries who share a river basin or aquifer. Unlike international river basins, however, federations share a unifying political identity, an overarching set of rules (e.g. constitution), binding legal mechanisms, enforcement capacity, and, often, conflict resolution mechanisms to address disputes between states.

Despite the importance of water governance in the world’s 25 federations, the topic has received limited attention before the past 10 years. The oldest federations, such as Australia and the USA, have been studied extensively. However, the relationship between water and federalism has only recently attracted broader interest. Briscoe (2014) highlighted the importance of federalism in water politics and governance and the need to account for (1) politics at all levels, (2) the influence of history and path dependency, (3) the role of both informal and formal rules and practices and (4) context-specificity of policy lessons and transfer. A series of additional studies have advanced our understanding of horizontal (state-to-state) and vertical (state-federal) interactions within river basins in federal political systems, illustrating how different jurisdictions behave opportunistically and depend on political and institutional safeguards to foster cooperation and resolve disputes (Garrick et al. 2016).

Recent research has developed a global and comparative perspective on water governance in federations, identifying ‘federal rivers’ as a distinct type of transboundary river basin. Federal river basins include ‘major river basins’ within or shared by a country with a federal political system (Garrick et al. 2013). Intergovernmental politics and coordination challenges are a defining and common feature of such river basins (Garrick and De Stefano 2016). At the same time, this category of river basin is diverse and varies in terms of their hydrological, economic and institutional attributes. Federal rivers can involve different levels of institutional fragmentation, including interstate river basins shared by multiple states within a single country, large river basins falling completely within a single state (intrastate) or basins that span both state and international borders (Fig. 1).

<sup>1</sup> Federations refer to sub-national jurisdictions with different terms: states, provinces, Länder, autonomous regions and cantons illustrate the range and diversity of approaches.

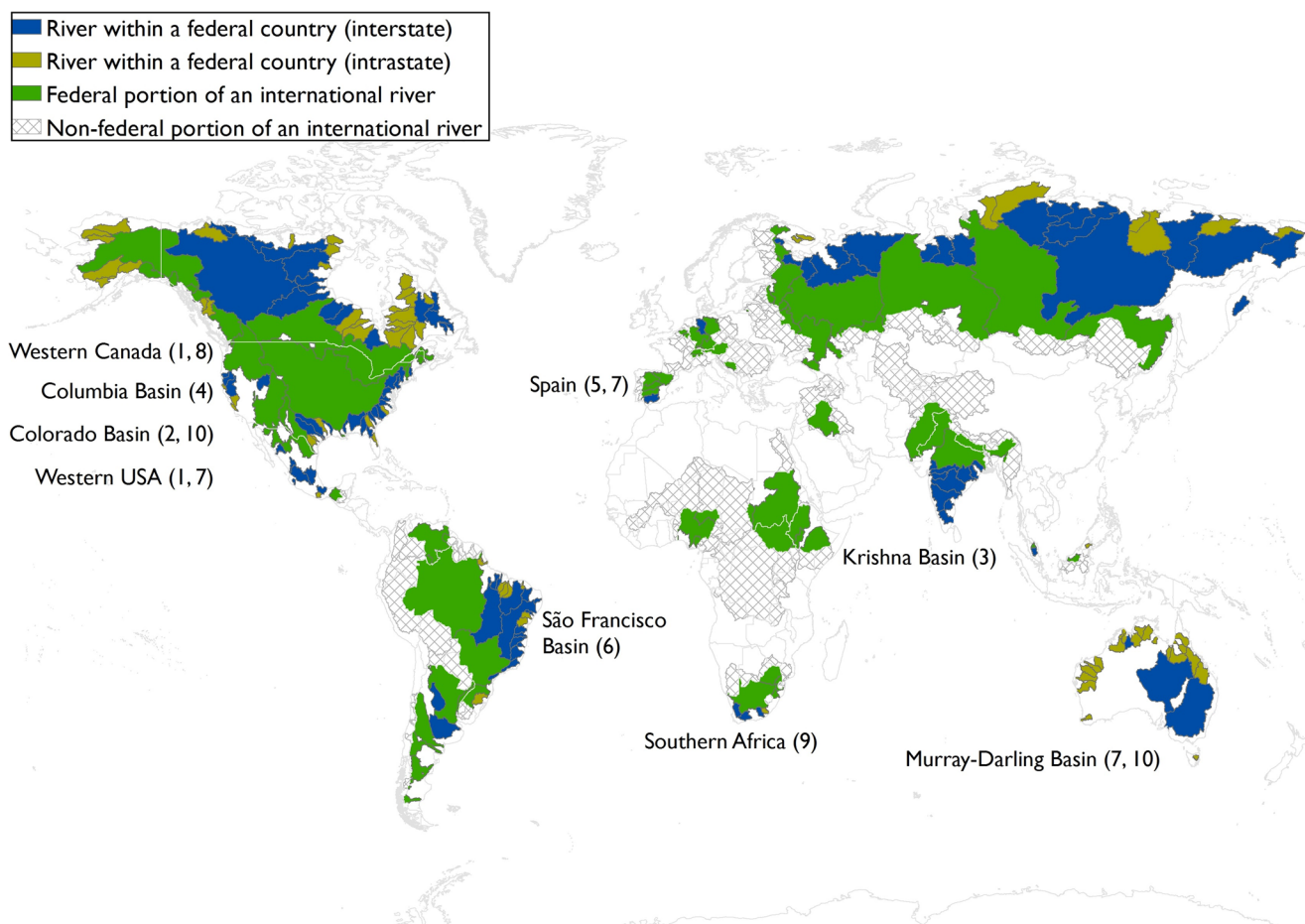
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**Fig. 1** The world's federal rivers and geographical distribution of studies within this special issue. Numbers refer to articles and their numerical listing in Table 1. Source: Adapted from Garrick and De Stefano 2016

Previous work focused on systematic analysis of federal rivers, by mapping the world's large rivers within or shared by federations (Garrick et al. 2013), and developing an interdisciplinary framework to assess and compare the evolution and performance of different institutional and governance approaches (Garrick and De Stefano 2016). With this special issue, we strive to move a step further by examining the unique challenges associated with water governance in federations and comparing different political dynamics and institutional responses.

Contributions to the special issue analyse distinct water management challenges through the lenses of federalism and multi-level water governance. The cases cover all six inhabited continents (Africa, Asia, Australia, Europe, North and South America) and a broad array of scales, from the river basin to entire countries and comparative studies (see Table 1 and Fig. 1). The level of decentralisation varies from the case of a highly decentralised political setting in Canada to the constitutionally unitary country in South Africa or a country like Spain defined by some as a 'quasi-federal' political system.

Despite differences in methodological approaches and geographic scope, the case studies share common features in their

analysis. All the papers focus on institutional mechanisms, governance arrangements and policy tools that are in place to manage decision-making processes in a context of distributed authority and institutional overlaps. Some articles analyse water governance arrangements through comparison, examining multiple countries or river basins in order to detect common trends and lessons learned from different settings (Benson 2018; De Stefano and Hernandez-Mora 2018; Garrick et al. 2018; Heinmiller 2018; Muller 2018; Wheeler et al. 2018). Several papers emphasise the importance of observing institutional arrangements over time (Chokkakula 2018; De Stefano and Hernandez-Mora 2018; Empinotti et al. 2018; Garrick et al. 2018), as decentralisation and intergovernmental relationships are constantly evolving to adapt to changing societies and power dynamics.

## Governance challenges

Water governance involves coordination challenges at all levels from within households to global supply chains. This special issue examines the governance challenges relevant to

**Table 1** Main characteristics of the contributions to this special issue

#	Contribution	Geographical focus	Approach	Main issues
1	Benson (2018)	Western USA and Western Canada	Comparative (between two federal countries)	Revision of reservoir operation rules
2	Berggren (2018)	Colorado basin (USA)	Decision analysis and regression modelling	Basin-wide planning decisions
3	Chokkakula (2018)	Krishna river basin (India)	Historical and policy analysis	Conflict resolution mechanisms, nexus between politics and water policy
4	Cosens et al. (2018)	Columbia basin (Canada and USA)	Legal analysis	Recognition and reconciliation of First Nations and Indigenous Peoples in basin governance
5	De Stefano and Hernandez-Mora (2018)	Spain	Comparative (within country)	Mechanisms for multi-level cooperation, drivers of conflict and cooperation
6	Empinotti et al. (2018)	São Francisco water transfer (Brazil)	Political ecology analysis	Approval and construction of water infrastructure
7	Garrick et al. (2018)	Australia, Spain and Western USA	Comparative institutional analysis	Water markets
8	Heinmiller (2018)	Alberta and Saskatchewan provinces (Canada)	Comparative (provinces within a federal river)	Water allocation rules
9	Muller (2018)	South Africa and Southern African countries	Comparative	Water resources planning, infrastructure development, systems management under drought
10	Wheeler et al. (2018)	Colorado (USA) and Murray Darling (Australia)	Comparative (between two federal rivers)	Development and use of water management models

federal political systems, where the territorial division of authority contributes to institutional fragmentation and associated distributional conflicts. This section highlights the major types of governance challenges across the studies in the special issue.

First, the distribution of authority between national and subnational governments adds a layer of complexity to water governance and opens up the debate about the ‘most suitable’ geographical unit of water resources management. Boundaries between political or administrative jurisdictions within federal countries can almost be as critical as the borders between countries. De Stefano and Hernandez-Mora (2018) illustrate the heated disputes that emerged during the past decade around the delineation of river basin district boundaries in Spain.<sup>2</sup> Representation of regional governments in river basin district boards and commissions is proportional to the territory of the basin district belonging to each region. Thus, some regional governments have repeatedly challenged the official decision in order to achieve the most favourable delineation. In India, a states’ territorial reorganisation in 1956 turned the Madras state (later renamed Tamil Nadu) into a non-riparian state to Krishna river, and created a new riparian state (Andhra Pradesh), thus changing the configuration of actors in the Telugu Ganga project (Chokkakula 2018). In Brazil, the

interbasin and interstate nature of the São Francisco transfer scheme created complex power dynamics and in practice meant that decision-making authority by river basin bodies and states was overruled by federal authority (Empinotti et al. 2018). The river basin level is not automatically the preferred scale for water governance; even when strong basin institutions exist, basin-wide planning efforts may struggle to integrate sustainability and equity into interstate decision making, particularly when water shortages are distributed unevenly, as experienced in the Colorado river basin (Berggren 2018).

Second, politics matters, but via distinct pathways that can be analysed and sometimes quite predictable or cyclical. The role of politics—and how it intertwines with water policy—clearly emerges as a common thread in several articles. Thus, Chokkakula (2018) illustrates the nexus of water infrastructure politics and mainstream party politics in relation to the approval and implementation of the Telugu Ganga project. The project was used by different political leaders both as a way of creating territorial cohesion (by India’s government) and as a political weapon for opposition to the central authority (by states’ governments). Muller (2018) in turn shows with several interstate and intrastate cases in Southern Africa the influence of different levels of government, economic lobbies and donors in the performance of several water functions. De Stefano and Hernandez-Mora (2018) illustrate that subnational intergovernmental interactions over water in Spain often are a reflection of relations in the broader political arena, where the model of political decentralisation currently is being

<sup>2</sup> In the European Union, the implementation of the Water Framework Directive has required Member States to delineate ‘river basin district’ meant as the area of land and sea, made up of one or more neighbouring river basins together with their associated groundwater and coastal waters, which is identified as the main unit for management of river basins.

questioned by some of the Spanish regions. The role of water governance in electoral politics raises important implications about the need to account for electoral cycles and politics in institutional design.

Third, several papers shed light on the challenges of representation and accountability in decision making to account for subnational and local interests. Thus, Empinotti et al. (2018) start from the story of approval and implementation of the São Francisco water transfer. The formula used to determine representation in decision-making bodies, as well as capacity asymmetries, can undermine participation and decentralised decisions in practice. The authors also remark the impact of the different speeds of Brazilian states in developing their institutional capacity and how that hinders an effective decentralisation of water management. Berggren (2018) finds that decision-making processes matter greatly to ensure that trust, participation and legitimacy are built into basin-wide planning efforts. The exclusion of key stakeholders can undermine accountability and legitimacy. Accountability mechanisms are particularly important for water reallocation in interstate river basins, as highlighted by Garrick et al. (2018); accessible information on reallocation and its impacts on other national and local policy goals underpins the legitimacy of water markets.

Fourth, the overlapping spheres of authority at the national and subnational levels exacerbate challenges of water allocation. In a federal context, the division of authority not only adds complexity but also opportunities for local innovation and policy diffusion. Thus, Heinmiller (2018) examines the role of federal and subnational governments in water allocation in Canada, finding that high levels of decentralisation in the Canadian context can foster innovation to match allocation policy to local conditions. However, such local autonomy can also pose constraints on interstate coordination and accommodation of national interests, as exemplified by the comparison of reservoir operations policies in the USA and Canada (Benson 2018). Garrick et al. (2018) start from a comparison of institutional arrangements to manage water trade in three federal countries (Australia, Spain and the USA). They find that effective interstate and central-local coordination is needed regardless of the level of decentralisation to deal with the distributional conflicts associated with reallocating water across political borders in interstate river basins.

Finally, federations pursue multiple, sometimes conflicting, goals. The challenges associated with reconciling environmental sustainability goals with other policy objectives within a federal context are examined by several authors. Benson (2018) analyses legal and policy issues affecting potential changes in reservoir operations as an adaptation strategy in the western USA and southern Alberta in light of the distribution of authority in the two federal countries. Cosens et al. (2018) illustrate the confrontation of hydropower versus salmon and development versus restoration present in

the negotiations of a new treaty on the Columbia river between the USA and Canada. Their paper emphasises not only the complexity but also the opportunities posed by negotiations between two federal countries, including the increasing opening for ecosystem values and participation of First Nations. De Stefano and Hernandez-Mora (2018) document the challenges associated with water policy goals evolving toward environmental sustainability in a context of changing power dynamics due to evolving decentralisation. Berggren (2018) and Garrick et al. (2018) show how water allocation in large basins involves multiple objectives, which cannot simultaneously be met, creating tension between upstream and downstream jurisdictions and between human and environmental water uses as water is reallocated.

## Responses to governance challenges

Responses to water governance challenges in federations cover a broad spectrum, from technical to legal or purely political. Finding ways of managing conflicts across subnational borders in these diverse settings has required innovation, capacity building and institutional arrangements to enable complex decision making and conflict resolution. Even in regions where responses have been effective, no solutions are permanent, echoing the findings of the Harvard Water Federalism Initiative (Briscoe 2014). The responses described in the papers illustrate the importance of matching the governance approach to the context, and ensuring adequate capacity for subnational governments to address challenges before they spread across jurisdictional boundaries.

First, information and knowledge sharing create platforms for coordination and conflict resolution. Based on the experience of the Colorado and the Murray Darling basins, Wheeler et al. (2018) observe that water resources models in federal governance structures act as ‘boundary objects’ to enable the sharing of knowledge across multiple state and national governments, stakeholder interests and disciplinary perspectives to support river basin planning. They conclude their analysis by pointing out the importance of including stakeholder knowledge in the development of the models and of ensuring transparency in how models are built and run in order to gain acceptance and relevance in participatory decision making. Their findings echo results from Spain, where De Stefano and Hernandez-Mora (2018) identify the importance of building capacity and coordination at the technical level to work across jurisdictions.

Second, federalism can spur policy innovation and adaptation by matching water governance closely to local conditions. This is evident in situations with high levels of decentralisation, such as Canada. Heinmiller (2018) shows examples of this phenomenon through the comparison of water allocation arrangements of two Canadian provinces—Alberta and

Saskatchewan. Despite their proximity and being bound by a shared river, the states have found very different policy solutions to address water scarcity. The author underscores that the two provinces have only limited competition with each other for water at this stage, which has meant that decentralisation allows policy innovation for designing different approaches to water allocation well suited to the unique conditions in each province. In the future, the differences in approaches may prove more problematic if competition between the provinces increases, requiring inter-provincial coordination.

Third, solutions to water governance often involve addressing fundamental constitutional debates and wider political disputes. Brazil and Spain are both relatively young and evolving federal political systems where unresolved tensions at the constitutional level are profoundly intertwined with other policy concerns. Thus, in Spain, at times tensions that manifest in the water policy arena are rooted outside of it and should be solved as part of a broader debate about the political system. Along the same lines, asymmetric relations between Brazil's federal government and some states are symptoms of shortcomings in the implementation of the decentralisation model as a whole and not only of pitfalls of the design of the water governance system itself. Even countries with long histories as federations confront recurring constitutional challenges due to water disputes, as experienced in Australia during the Millennium Drought, leading to the creation of a new federal authority to address basin-wide planning.

Fourth, coordination institutions are needed to facilitate cooperation and conflict resolution. Venues for effective interstate cooperation can involve a range of informal and formal mechanisms. Reliance on courts alone is insufficient. It can prolong decisions and create winner-loser dynamics. This is the case in Spain, where the constitutional and the supreme courts were asked to decide about distribution of authority and the boundaries of water management units. In India, Chokkakula (2018) points out that venues for seeking cooperation and coordination between states are included in the Indian law but few of them are actually in place and those that exist have little legal capacity. Thus, focus is placed on conflict management through interstate water disputes resolution mechanisms—water tribunals—which in turn seem to be ineffective in finding long-term solution to disputes. Garrick et al. (2018) illustrate how coordination institutions are needed to address the conflicts and tensions associated with water reallocation, particularly when water moves across state borders or involves federal (national) acquisitions of water for environmental purposes. Regardless of the level of decentralisation, a portfolio of coordination mechanisms has been needed for interstate water planning, financing infrastructure and sharing data.

Finally, the limitations of courts and formal coordination venues has underscored the importance of informal networks to bridge gaps. Thus, Cosens et al. (2018), Berggren (2018)

and De Stefano and Hernandez-Mora (2018) point out how they can be used to build trust and foster cooperation in formal venues. Finally, Muller (2018) remarks the role of informal interactions of key governmental and nongovernmental actors in contributing to effective (or not) performance of water governance functions such as infrastructure development and management of droughts. All these authors also warn against the risks associated with the potential decrease in transparency and accountability.

## Future research directions

Federal rivers are a distinct type of transboundary river basin, but they are highly diverse. Together, the papers illustrate the evolving governance challenges in federations and the diversity of global experience responding to these challenges. The examples from the special issue highlight differences between cases and over time for a set of key themes: decentralised versus centralised governance, reliance on formal versus informal institutions for coordination and conflict resolution, and the need to balance basin-wide versus local decision making. Each of these issues illustrate the coordination challenges in federations.

The papers from the special issue suggest that federalism is an important variable in regional environmental politics and governance with implications for theory, evidence and practice. Theoretically, federalism contributes to wider research advances on multi-level governance, and intersects with transdisciplinary research on the governance of social-ecological systems through networks, polycentric governance arrangements and hybrid approaches that blend markets, communities, states and transboundary institutions. The systems theory of federalism developed by Bednar (2008) identifies some of the key areas for future research. She argues that the distribution of authority and safeguards in federal political systems are integral to problem solving and adaptation for complex societal challenges like water and the management of other natural resources; a better understanding of the factors and institutions shaping conflict and cooperation in federations can yield insights for designing and evaluating coordination institutions to work across political borders and levels of government as water scarcity, shortages and climate shocks intensify.

Empirically, there has been increasing attention by scholars and practitioners to define—and measure—indicators of good governance; the coordination issues in federations are often missing from this analysis. Existing indicator frameworks focus on national water policies and local capacity. The collected papers on water governance in federations show that federal rivers have specific coordination challenges, and opportunities for innovation, that are relevant in these discussions. Future research on water governance indicators can focus on

coordination institutions for cooperation and conflict resolution and identify, measure and compare their design and performance across different settings. Studies of water governance in federations cannot strictly rely on static snapshots, however, but should build observatories of institutional adaptation that facilitate rigorous benchmarking and evaluation over time. The studies in this special issue show that diverse methods are used for such longitudinal analysis, and there are opportunities for methodological innovation and rigour in areas of process tracing, network analysis and multi-method approaches. Increasing analysis of historical institutional change and performance can identify trajectories and trends that enrich understanding of adaptation and inform current and future institutional reforms. Such research can also improve our understanding of the interplay of water politics, electoral politics and constitutional changes in federations.

Key future research priorities will identify how federations vary and how this variation influences patterns of conflict and cooperation in water governance. The special issue highlights some of the emerging questions. How does decentralisation affect distributional conflicts in water allocation and the adaptive capacity to deal with rapid social, economic and environmental changes in shared river basins? What is the appropriate blend and sequencing of coordination institutions to facilitate cooperative development of river basins and negotiate trade-offs, and how do these vary across political, economic and environmental conditions? How are water politics linked with electoral cycles and constitutional choices, and what are the implications for water governance?

Addressing these questions will contribute to both research and practice. It will require continued commitment to a multi-pronged research programme and community of practice, including initiatives such as the Forum of Federations Federal Rivers project ([www.federalrivers.org](http://www.federalrivers.org)). Indicators of good governance in federal political systems, assessments of cases over time and comparative research can offer an appropriate blend of depth and breadth to generate insights for regional responses to complex and contentious water policy challenges in a period of rapid change.

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