

A systematic review of Indigenous peoples' participation in dominant systems of water governance

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Indigenous peoples' rights and responsibilities to water are routinely undermined by dominant or colonial water governance systems. Although the importance of engaging Indigenous peoples in water governance is recognized, few studies have assessed the extent or nature of their participation. Here we present a systematic review of peer-reviewed literature on Indigenous participation in dominant water governance, analysing 226 journal articles and 183 case studies. Case studies span 15 countries, with the majority (77%) from Western settler-colonial countries. Forms of participation differ across regions, and some decision-making scales are better studied than others. Few participatory processes give consideration to Indigenous values and knowledge, and even fewer evaluate Indigenous participation, making it difficult to determine whether such participation was meaningful. Participation in international water governance processes is evident but remains underexamined in the literature. Crucially, Indigenous peoples are influencing and reshaping dominant water governance at all levels.

Participation is widely considered an essential tenet of good water governance^{1,2}, with the potential of facilitating inclusion of diverse knowledge systems and values in decision-making processes^{1,3–5}. In particular, there has been increasing interest in engaging Indigenous peoples in water-related decision-making processes⁶, especially as there may be a legal imperative in certain instances to do so^{7,8}. The growing calls for Indigenous participation have further been driven by the recognition of Indigenous rights, reflected in the adoption of the United Nations Declaration on the Rights of Indigenous Peoples⁹, and the acknowledgement of the role that Indigenous knowledge and values can play in water governance^{6,10}.

Efforts are seemingly underway to increase participation of Indigenous peoples in water governance in several countries^{11,12}. This is reflected in the growing body of academic literature that documents engagement in numerous areas, including water rights^{13–16}, wastewater¹⁷, water research¹⁸, Indigenous knowledge¹⁹, water policy settings²⁰, watershed management²¹ and river basin management²². In addition, there is burgeoning literature on Indigenous water governance,

grounded in concepts of self-determination and sovereignty^{23–26}, Indigenous water justice^{27,28} and Indigenous ontologies^{29,30}.

Despite these developments, several barriers to Indigenous participation in dominant water governance frameworks persist^{12,17,31}. Besides procedural barriers related to resourcing and capacity³², dominant processes disregard the inherently political nature of water, framing water governance issues as purely technical issues^{33–35}. In addition, dominant processes often relegate Indigenous peoples to the status of 'stakeholders', failing to acknowledge their rights and authorities³⁶. While there is ample literature offering 'recommendations' on how water and environmental governance processes should involve Indigenous peoples^{11,17}, no systematic review has been undertaken that examines how and to what extent current water governance processes have engaged Indigenous peoples.

Prior studies have conducted systematic reviews concerning Indigenous peoples' engagement in climate adaptation and governance^{37–41}, in collaborative environmental governance⁴², in nature conservation⁴³, in marine and coastal management⁴⁴, and in global environmental

Table 1 | Boolean string used for search strategy

Scopus	(TITLE-ABS-KEY ("indigenous" OR "first nations" OR "aboriginal" OR "inuit OR maori") AND TITLE-ABS-KEY ("water polic*" OR "water strateg*" OR "water plan*" OR "water management" OR "water governance" OR "watershed plan*" OR "basin plan*" OR "water reform*" OR "water resources management" OR "Water law*" OR "water rights")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English"))
Web of Science	(TS=("water polic*" OR "water strateg*" OR "water plan*" OR "water management" OR "water governance" OR "watershed plan*" OR "basin plan*" OR "water reform*" OR "water resources management" OR "Water law*" OR "water rights")) AND TS=("indigenous" OR "first nations" OR "aboriginal" OR "maori OR inuit) and Article (Document Types) and English (Languages)

forums⁴⁵. While several of these reviews include a peripheral discussion on water, systematic reviews focused solely on water governance processes are generally limited. The few systematic reviews specifically related to Indigenous involvement in water governance have been limited in scope; for instance, studies have examined Indigenous involvement in source water protection in Canada and the USA⁴⁶ and the integration of Indigenous and Western knowledge in water research in Canada, Australia, New Zealand and the USA⁴⁷. More recently, Leonard et al.⁴⁸ conducted a review of Indigenous-led water research that advocates for the 'rematriation' or the return of water back to Indigenous communities, thereby highlighting key themes in Indigenous water governance scholarship⁴⁸.

While this study affirms the rights of Indigenous peoples to self-determination and to govern their waters in accordance with their own frameworks, it also recognizes the importance of examining Indigenous participation in dominant systems of water governance, including those that claim to be collaborative³⁶. Dominant water governance processes influence water policy decisions and discourse, often with direct and indirect impacts on Indigenous peoples. In many cases, Indigenous peoples are forced to participate or respond to these processes in order to defend their rights and interests^{49,50}. Participation, understood here as the way in which Indigenous peoples engage with external actors or institutions, is further influenced by issues of scale. For instance, the scale of participation can have implications on how much power and influence actors have^{51–54}. Indigenous peoples with contextualized knowledge may be well positioned to shape local water governance decisions, but may face challenges in influencing decisions at broader, jurisdictional levels⁵¹. Conversely, decision-makers operating at higher jurisdictional scales often possess the authority to shape overarching water agendas, yet they may lack insight into how their decisions impact local communities^{51,55}. Here, we systematically review the literature to understand how Indigenous peoples are participating, interacting and responding to dominant water governance processes across a range of geographies, scales and themes following the process detailed in Tables 1–3 (search strategy, inclusion/exclusion criteria, and coding scheme) and summarized in Fig. 1 (flow diagram).

Results

Geographical distribution

A total of 226 journal articles were reviewed from which 183 unique case studies were extracted, spanning 15 countries (Fig. 2). 85% ($n = 193$) of the journal articles discussed one or more of the four countries: Australia ($n = 78$; 35%), Canada ($n = 47$; 21%), the USA ($n = 45$; 20%) and New Zealand ($n = 31$; 14%), including transboundary examples. These countries, often referred to as CANZUS, are settler-colonial states where Western colonization resulted in permanent settlement and displacement of the Indigenous population. Case studies followed a similar distribution, with the highest numbers from Australia ($n = 57$; 31%), Canada ($n = 32$; 17%), the USA ($n = 27$; 15%) and New Zealand ($n = 19$; 10%).

Fourteen ($n = 14$; 6%) articles discussed six transboundary case studies, all along the USA–Canada border. These transboundary case

Table 2 | Inclusion criteria at screening and eligibility

Inclusion criteria	Abstract and title screening	Full-text eligibility
In English	X	X
Explicitly discussing issues of or related to water governance	X	
Explicitly discussing Indigenous peoples or their knowledge and values.	X	
Published in a journal article		X
Distinct example or case study of Indigenous participation or inclusion in dominant processes for water governance		X
Example must be related to real-life policy		X
Example must demonstrate Indigenous peoples engaging or responding to an external actor		X

studies discussed Indigenous participation within the Great Lakes^{56–59}, the Columbia River Basin^{60–63}, the Rainy Lake⁶⁴, the Yukon River basin, between Yukon and Alaska^{30,65}, the Coast Salish region⁶⁶ and the International Joint Commission⁶⁷.

In addition, 19% of journal articles ($n = 43$) discussed 38 distinct case studies from South America, with Chile having the highest number of both journal articles ($n = 15$) and case studies ($n = 10$). Outside of this, there were three isolated examples of Indigenous participation: of the Ainu in Japan⁶⁸, Indigenous peoples in New Caledonia⁶⁹ and the Saami in Sweden⁷⁰.

Bibliometrics

Journal representation. The articles were represented in 106 different journals across various disciplines, from water resources and hydrology to law, social sciences and human rights. The greatest number of articles were published in the *International Journal of Water Resources Development* ($n = 11$) and *Water* ($n = 11$), followed by the *Australasian Journal of Water Resources* ($n = 10$).

Year of publication. The articles ranged from 1980 to 2023. Notably, 80% of the articles ($n = 180$) reviewed were published in the past 10 years (2013–2023).

Indigenous participation in dominant water governance processes by geography

Most participatory processes were generalized or undefined, with participation types clustered in distinct geographies. While noting the challenges and limitations of coding complex processes of participation (Table 4), case studies did highlight trends in terms of how Indigenous participation is reflected or discussed in the existing literature. In particular, notable variation was observed in both the type and thematic focus of participation across different geographical contexts (Table 5).

In many case studies, the type of participation was either unspecified, generalized or a policy engagement process ($n = 43$; 23%). These examples were most prevalent in Australia ($n = 16$) and Canada ($n = 12$). Another 23% of case studies discussed legal engagement processes ($n = 42$), such as lawsuits, court proceedings or settlements. Many of these were from the USA ($n = 19$). An additional 16% of case studies focused on Indigenous partnerships and collaborations ($n = 29$), predominantly in Australia ($n = 14$) and Canada ($n = 8$). In the USA, there were two examples of partnerships: one of the Lummi Nation within the state of Washington⁷¹, and one along the Colorado River⁷².

Several case studies discussed Indigenous participation in the form of resistance and political mobilization, such as protests ($n = 30$; 16%). Among these, 83% ($n = 25/30$) were from South America. Case

Table 3 | Coding scheme

Variables used to code journal articles	Coding
1. Reference (authors, year, title and journal)	–
2. Geographical area	Deductive
3. Are Indigenous peoples the focus of the study? (Y/N)	Deductive
4. What thematic focus or issue of water governance are Indigenous peoples engaging in?	Open code
5. What case study or example is discussed?	–
6. How are Indigenous peoples participating?	Open code
7. Who are Indigenous peoples participating with?	Open code
8. At what scale is the participation taking place?	Deductive
9. Does the literature discuss details about the participation? (Y/N)	Deductive
10. Does the literature evaluate the participation? (Y/N)	Deductive
11. Are Indigenous values, norms or methods used in the participation process? (Y/N)	Deductive
Variables used to code case studies	
1. Case study details	Open code
2. What thematic focus or issue of water governance are Indigenous peoples engaging in?	Open code
3. How are Indigenous peoples participating?	Open code
4. Who are Indigenous peoples participating with?	Deductive
5. At what scale is the participation taking place?	Deductive
6. Are there details about the participation? (Y/N)	Deductive
7. Are Indigenous values, norms or methods used in this participation process? (Y/N)	Deductive
8. Is there an evaluation of the participation? (Y/N)	Deductive
9. Paper detailing the evaluation (cross reference to paper)	–

studies of recognition followed ($n = 25$; 14%), and these were predominantly from Australia ($n = 15$). Several of these discussed how colonial water laws and policies have made provisions for Indigenous peoples and their interests, but in most cases there was little context provided as to how Indigenous peoples' active involvement led to this recognition, or whether this recognition was beneficial to Indigenous peoples' self-determination.

Moreover, 13% of case studies were coded as 'representation' ($n = 24$; 13%), whereby Indigenous peoples were provided a seat in colonial water governance bodies. Representation was the main form of participation in transboundary case studies, for example in the Great Lakes, where Indigenous peoples were given representative seats on the Great Lakes Indian Fish and Wildlife Commission⁷³, the Great Lakes Science Advisory Board⁵⁷ or the International Joint Commission⁶⁷.

Eight per cent of the case studies discussed the inclusion and application of Indigenous peoples' knowledge and values in water policies or laws ($n = 15$; 8%). These were concentrated in New Zealand ($n = 5$), Australia ($n = 4$) and Canada ($n = 4$). In New Zealand and Australia, case studies discussed initiatives to identify or map cultural values or cultural flows in water bodies, for instance the Cultural Health Index^{74–76}, Murihiku Cultural Water Classification System⁷⁷ and the National Cultural Flows Research Project^{76,78–80}. Cultural flows refer to water entitlements owned and managed by First Nations communities in Australia often for their cultural and social use. Meanwhile, in Canada, case studies dealt with the application of Indigenous principles, values or knowledge systems^{10,35,81,82}. The one transboundary case study that dealt with Indigenous knowledge inclusion discussed consideration of Indigenous knowledge in the governance of the Great Lakes within Canada^{18,83}. A small number of case studies discussed

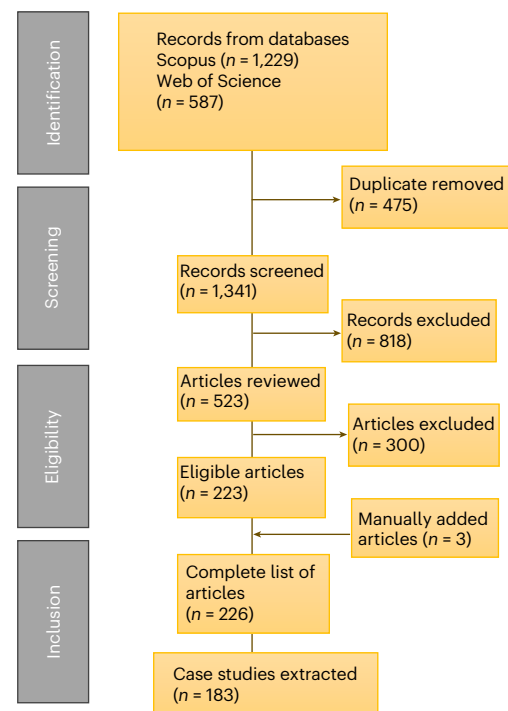


Fig. 1 | Flow diagram of systematic review. PRISMA-style flow diagram showing the systematic literature review process, across four-phases: identification, screening, eligibility and inclusion.

negotiation processes ($n = 10$; 5%), referring to processes that led to some form of agreement or accord. These overlapped with several legal engagement case studies. An even smaller number discussed formal consultation processes ($n = 8$; 4%), which were often legally required as part of environmental impact assessments or permitting for dams or mining projects.

Figure 3 shows the distribution of the participation types across different geographies, with percentages calculated as a fraction of the total of participation type.

Most of the participation took place around the thematic issues of colonial water rights and laws. The case studies discussed a variety of thematic issues, with the majority focusing on water rights and water laws within colonial processes ($n = 40$; 22%). These examples were concentrated in the USA ($n = 17$). Case studies on general water issues or water governance followed ($n = 36$; 20%), with the majority from Australia ($n = 22$) discussing how colonial water laws and policies included Indigenous peoples. In addition, 15% of the case studies focused on extractive projects, including dams and mining ($n = 28$), around half of which were situated in South America ($n = 15$). This was followed by case studies around specific water bodies, rivers and lakes ($n = 22$; 12%), many of which were concentrated in New Zealand ($n = 11$). Case studies examining drinking water or source water protection ($n = 15$; 8%), a majority of which were in Canada ($n = 10$).

Indigenous knowledge and values are considered in very few participatory processes. Out of 183 case studies, 19% ($n = 34$) indicated that Indigenous values or knowledge were considered in the participation process (Table 5). Most of these examples were from Australia ($n = 13$) and New Zealand ($n = 11$). While several of these examples were also coded as 'inclusion of Indigenous knowledge' for the type of participation, there were other types of participation, such as partnerships, that considered Indigenous values.

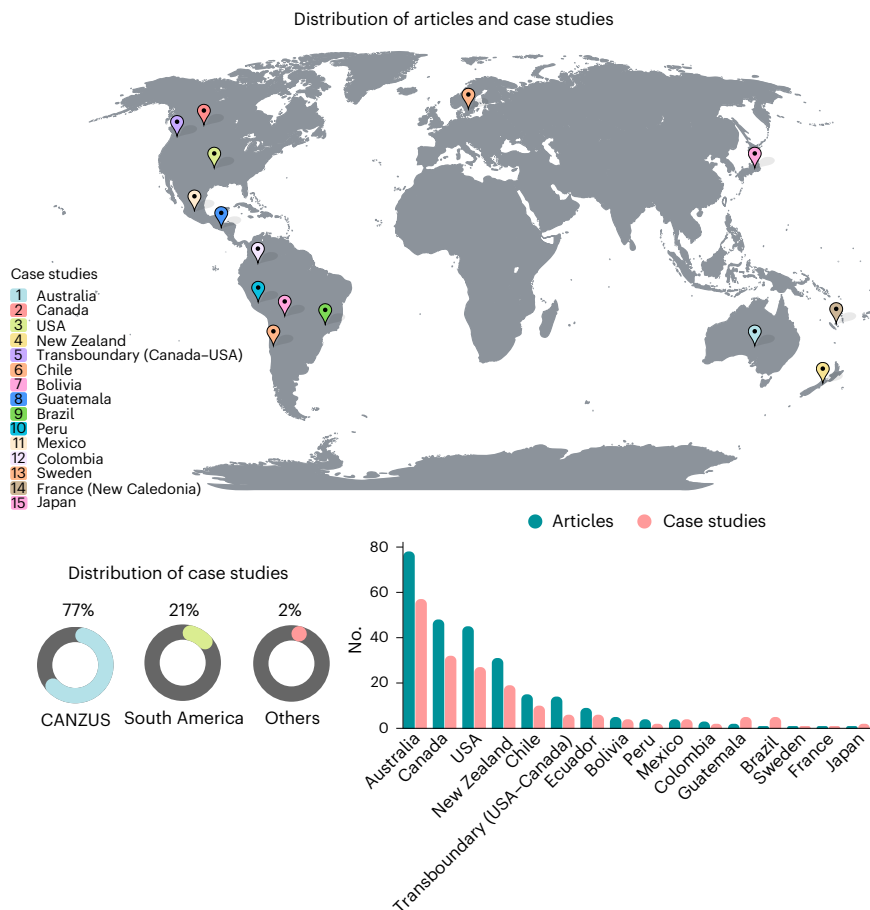


Fig. 2 | Geographical distribution of journal articles and case studies. Transboundary case studies (USA–Canada) are reported as a separate category and are not included in individual country totals.

Given that such a small percentage of case studies considered Indigenous values based on the documented literature, it is likely that dominant processes of water governance continue to view water primarily as a resource that can be technically managed and controlled. This is at odds with how many Indigenous peoples may view water^{29,73,84}.

There was limited description of participatory processes, and even fewer studies evaluated them, with most evaluations conducted in Australia. In only 55% of the case studies ($n = 101$), a description of the process of Indigenous participation was provided. Among these, approximately a quarter ($n = 27$) included some form of evaluation. Most evaluations were from studies conducted in Australia ($n = 13$), followed by Canada ($n = 5$), and were generally limited to a few sentences about the process (Supplementary Section 8). No consistent framework guided these evaluations, making it challenging to assess the evaluation itself. There was only one case study where Indigenous peoples took part in the process of evaluation, namely the evaluation of the Murray Darling Basin Plan^{31,85}.

Indigenous participation in dominant water governance by scale

Indigenous participation is commonly reported at the local scale, particularly in South America, predominantly at the provincial scale in Canada, and rarely documented at the international scale. Several case studies illustrated the involvement of multiple jurisdictional scales. Around 26% of the case studies ($n = 48$) involved two or more scales (Fig. 4). Overall, about 44% of the case studies discussed Indigenous participation at the local scale ($n = 81/183$). In South America particularly, 74% of the case studies discussed local-scale

participation ($n = 28/38$). This was followed by case studies that discussed participation at the federal ($n = 57$; 31%) and regional ($n = 47$; 26%) scales. In addition, 23% of the total case studies demonstrated Indigenous participation at the provincial scale ($n = 42$).

Notably, in Canada, more than half of the case studies demonstrated provincial-scale participation ($n = 19/32$), while both Australia and the USA each had 11 examples of provincial participation. In addition, six case studies addressed transboundary-scale participation, all of which involved the USA and Canada.

Only seven case studies ($n = 7$; 4%) discussed Indigenous participation at the international scale. These included: (1) Indigenous participation at the 3rd World Water Forum leading to the Kyoto Water Declaration^{8,65,78}; (2) participation at the 4th World Water Forum in Mexico City leading to the Tlatokan Atlahuak Declaration⁸; (3) The Garma International Indigenous Water Declaration in Australia, convening Indigenous peoples from all over the world⁷⁸; (4) Indigenous inclusion in the 2018 Brasilia Declaration of Judges on Water Justice at the 8th World Water Forum¹⁵; (5) the community of Carhuanchu, Huancavelica's efforts to present their case at the Latin American Water Tribunal⁵²; (6) Indigenous resistance around the Chixoy dam in Guatemala, leading to participation at the Inter-American Human Rights court⁸⁶; and (7) the Wayuu community's participation at the Inter-American Human Rights Court around the Cercado dam⁸⁷. None of these examples provided any substantial details around how Indigenous peoples participated in these processes. Nevertheless, some of these articles did imply that international spaces and forums have served as arenas for Indigenous peoples to contest hegemonic water norms and to advocate for a right to water^{52,86,87}.

Table 4 | Definitions for participation codes

Code	Definition	References
Recognition	Recognition refers to when certain groups are ‘recognized’, which could be on the basis of their common humanity, their differences or their individuality ¹⁵¹ . While multiple models of recognition exist, not all forms of recognition necessarily advance Indigenous aspirations ¹³ and can even undermine Indigenous self-determination, especially within a settler-colonial context ^{152,153} . We code case studies as recognition, where Indigenous peoples or their knowledge systems have been recognized or acknowledged in water laws, policies and plans, symbolically or otherwise.	McBride, 2005 ¹⁵⁴ Coulthard, 2007 ¹⁵³ Simpson, 2016 ¹⁵² Jackson, 2018 ¹³ Taylor, 2021 ¹⁵¹
Representation	Representation refers to when seats on representative bodies are reserved for members of certain groups for example Indigenous peoples ¹⁵⁴ .	McBride, 2005 ¹⁵⁴
Inclusion of Indigenous knowledge and values	Inclusion is defined as the act of ‘including’, and there can be varying levels of inclusion. We code case studies as inclusion of Indigenous knowledge and values, where Indigenous peoples’ knowledge systems, perspectives and values are explicitly considered in the participatory process.	Quitian and Rodríguez, 2016 ³¹
Consultation	Consultation is a process where governments (or industry) consult Indigenous peoples, ‘through appropriate procedures’ when taking any measures that affect them ¹⁵⁵ . In this review, consultation refers to formal processes legally required for permitting projects or conducting assessments.	ILO, 1989 ¹⁵⁵
General, undefined participation or policy engagement	Any form of participation which is unclear, generalized or undefined. We also consolidated this with general policy engagement processes which can be viewed as the range of activities that can impact ‘government policies or political systems’ ¹⁵⁶ .	Kim et al., 2023 ¹⁵⁶
Partnerships and collaborations	All forms of participatory processes where the term ‘partnership’ or ‘collaboration’ has been used.	von der Porten et al., 2016 ⁵
Legal engagement	Legal engagement refers to processes where Indigenous peoples engage with dominant legal systems, including in legal proceedings, litigation, settlement agreements or court cases such as around water rights or treaties.	Gilbert, 2020 ¹⁵⁷
Negotiations	Negotiations refers to policy or legal engagement processes that lead to an agreement or accord.	Gilbert, 2020 ¹⁵⁷
Resistance and political mobilization	Refers to all forms of movements and initiatives where Indigenous peoples contest and oppose state policies and laws and, thus, engage in ‘created’ spaces of participation ¹²⁶ . Includes forms of advocacy, political mobilization, protests and marches.	Jackson, 2018 ²⁷ Van Buuren et al. 2019 ¹²⁶

Resistance occurs primarily at the local scale, legal processes mostly at the federal scale, while Indigenous values and knowledge are important across all scales. The types of participation were distributed generally evenly across the different scales (Table 6). Among the 81 case studies discussing local-scale participation, an equal number focused on general participation or policy engagement ($n = 23$; 28%) and resistance or political mobilization ($n = 23$; 28%). Nearly half the examples of representation occurred at the local scale ($n = 11/24$). Among the 47 regional-scale case studies, participation mainly took the form of legal engagement ($n = 15$), partnerships or collaborations ($n = 12$) and resistance ($n = 11$). Legal engagement was also the most common form of participation at the provincial ($n = 14/42$) and federal scales ($n = 25/57$).

As mentioned earlier, only a few case studies stated that they considered Indigenous values or knowledge in the participatory process ($n = 34$; 19%), but they did so across different jurisdictional scales, including at the international scale. In fact, at the international scale, several studies discussed how Indigenous peoples elicited their values and knowledge in their own declarations^{8,15,65,78}. Within the transboundary examples, the example of the Great Lakes specifically discusses the inclusion of Indigenous knowledge and values within Canada^{18,83}.

Besides water rights, several issues are addressed at local and regional scales, although multiple scales are often involved. Most thematic issues involved participation at the local scale (Table 6). Case studies discussing water rights and law were prominent at the federal ($n = 24$) and provincial scale ($n = 14$). At the regional scale, case studies discussed multiple thematic issues. At the international scale, the thematic focus was primarily on general water issues ($n = 4/7$). More technically oriented topics such as conservation, watershed management, and environmental watering and environmental flows were largely addressed at local scales.

Notably, the local scale was more thoroughly described, even in studies that involved multiple scales. Among the case studies that provided descriptions of participation ($n = 101$; 55%), 45% of these

discussed local participation ($n = 45$) and 30% discussed regional participation ($n = 30$). There were three case studies that involved the international scale, which also provided description of the participatory process^{52,86,87}. However, these case studies involved multiple jurisdictional scales, with the descriptions primarily focused on the domestic participatory process, and limited detail of participation at the international scale.

Discussion and conclusion

We provide a systematic review of peer-reviewed journal articles that explore Indigenous participation in dominant systems of water governance. Before discussing results, we acknowledge that even a review of the literature involving Indigenous peoples can be contentious, with the potential for misrepresentation. For instance, readers may not appreciate that this review is focused on Indigenous participation in dominant water governance processes. We understand that these processes often view Indigenous peoples as ‘stakeholders’, depoliticize water issues and often undermine Indigenous peoples’ sovereignties and jurisdictions^{6,29,35,88}. We are mindful of these concerns and undertake this review not to validate dominant or colonial systems, but to critically assess how Indigenous peoples are participating in, or being excluded from, such processes that claim to be just and ‘inclusive’. In doing so, we hope to advance discussions of procedural and recognitional justice as it pertains to Indigenous peoples in water governance²⁷ (see Supplementary Section 4 for positionality and ethical considerations).

The type and theme of Indigenous participation depend on context, with certain contexts being more extensively studied than others

One of the notable findings from this review is that the type of participation and the thematic area of participation vary by geography. This variation likely stems from unique historical, political and environmental contexts that shape Indigenous participation in different regions. In the CANZUS countries, a substantial portion of the reviewed literature highlighted the impact of colonial water laws

Table 5 | Type and theme of participation by geography

	Total	Australia	Canada	USA	New Zealand	South American countries	Other countries	Transboundary (USA/Canada)
Total	183	57	32	27	19	38	4	6
Type of participation								
General, undefined participation or policy engagement	43 (23%)	16 (28%)	12 (38%)	3 (11%)	5 (26%)	3 (8%)	2 (50%)	2 (33%)
Legal engagement	42 (23%)	4 (7%)	4 (13%)	19 (70%)	6 (32%)	7 (18%)	1 (25%)	1 (17%)
Resistance and political mobilization	30 (16%)	–	1 (3%)	4 (15%)	–	25 (66%)	–	–
Partnerships and collaborations	29 (16%)	14 (25%)	8 (25%)	2 (7%)	5 (26%)	–	–	–
Recognition	25 (14%)	15 (26%)	4 (13%)	2 (7%)	2 (11%)	1 (3%)	1 (25%)	–
Representation	24 (13%)	11 (19%)	3 (9%)	1 (4%)	1 (5%)	3 (8%)	–	5 (83%)
Inclusion of Indigenous knowledge and values	15 (8%)	4 (7%)	4 (13%)	–	5 (26%)	1 (3%)	–	1 (17%)
Negotiations	10 (5%)	2 (4%)	2 (6%)	4 (15%)	1 (5%)	1 (3%)	–	–
Consultation	8 (4%)	1 (2%)	1 (3%)	–	1 (5%)	5 (13%)	–	–
Thematic issue								
Water rights and laws	40 (22%)	6 (11%)	2 (6%)	17 (63%)	3 (16%)	12 (32%)	–	–
General water and water governance	36 (20%)	22 (39%)	3 (9%)	1 (4%)	2 (11%)	4 (11%)	2 (50%)	2 (33%)
Dams, mining and development projects	28 (15%)	4 (7%)	3 (9%)	4 (15%)	–	15 (39%)	2 (50%)	–
Lakes or rivers	22 (12%)	4 (7%)	2 (6%)	2 (7%)	11 (58%)	–	–	3 (50%)
Drinking water and source water protection	15 (8%)	2 (4%)	10 (31%)	–	–	3 (8%)	–	–
Indigenous knowledge and cultural values	13 (7%)	5 (9%)	3 (9%)	–	4 (21%)	–	–	1 (17%)
Water quality and pollution	13 (7%)	1 (2%)	–	9 (33%)	–	3 (8%)	–	–
Conservation and watershed management	12 (7%)	1 (2%)	9 (28%)	–	–	1 (3%)	–	1 (17%)
Environmental watering/flows	10 (5%)	10 (18%)	–	–	–	–	–	–
Groundwater	5 (3%)	3 (5%)	–	1 (4%)	–	1 (3%)	–	–
Floods	3 (2%)	–	2 (6%)	–	1 (5%)	–	–	–
Is there a description of the participation?								
Yes	101 (55%)	39 (68%)	12 (38%)	16 (60%)	10 (53%)	16 (42%)	3 (75%)	5 (83%)
Is there an evaluation of the participation?								
Yes	27 (15%)	13 (23%)	5 (16%)	3 (11%)	1 (5%)	1 (3%)	–	4 (67%)
Are Indigenous knowledge and values included?								
Yes	34 (19%)	13 (23%)	6 (19%)	–	11 (58%)	2 (5%)	1 (25%)	1 (17%)

The percentages reported in the table are calculated as a fraction of the total case studies within each country or region, while the percentages under the totals are calculated as a fraction of the total number of case studies ($n=183$). All percentages have been rounded. South American countries include Chile, Ecuador, Peru, Bolivia, Colombia, Brazil, Mexico and Guatemala. Other countries include Japan, France (New Caledonia) and Sweden.

and policies on Indigenous communities^{64,89,90}. These policies have not only impacted Indigenous peoples' ability to exercise their rights and responsibilities towards water¹⁹ but have also contributed to water insecurity within Indigenous communities^{91,92}. However, the way water insecurity manifests across these different contexts varies, leading Indigenous communities to respond to and engage with each situation in different ways. In Canada, several of the journal articles discussed the challenges of safe drinking water provision and source water protection, especially as Indigenous communities in Canada continue to grapple with drinking water advisories^{17,93,94}. Generally, the literature from Canada described participation as a long-term policy engagement process between First Nations and the respective government. Collaborative participatory processes took place at the local scale, often in British Columbia, such as in the Koksilah watershed⁸² and the Lower Similkameen³². In Australia, water scarcity has been the main driver for how the government defines its overarching water policies, and the challenge has been around how to allocate scarce water across a range of uses and users, including Aboriginal peoples. As a result, water is a deeply political issue. Despite this, several examples

of Indigenous collaborations exist, including those with the Nari Nari Tribal Council^{95–100} and the Ngarrindjeri nation^{20,24,96,98,101,102}. The majority of journal articles that provided description and evaluation came from Australia. This does not necessarily imply that participation was more meaningful but rather reflects the political and social prominence of water issues in Australia.

In the USA, a substantial proportion of the literature discussed legal engagement processes, particularly around tribal water right and settlements. A majority of the case studies were focused on tribes along the Colorado River Basin^{23,103–109}. Not surprisingly, several of the papers were published in law journals, and the earliest paper in our review from 1980 was also from the USA.

In New Zealand, much of the reviewed literature discussed how the Treaty of Waitangi, signed in 1840, allowed the Māori to be the guardians of their *taonga* (treasures)¹¹⁰. Given this context, literature was focused on the governance of specific water bodies, such as the Waikato River^{111–114} and the Whanganui River^{115,116–118}.

Case studies within South America generally focused on Indigenous peoples' political mobilization and activism around water issues.

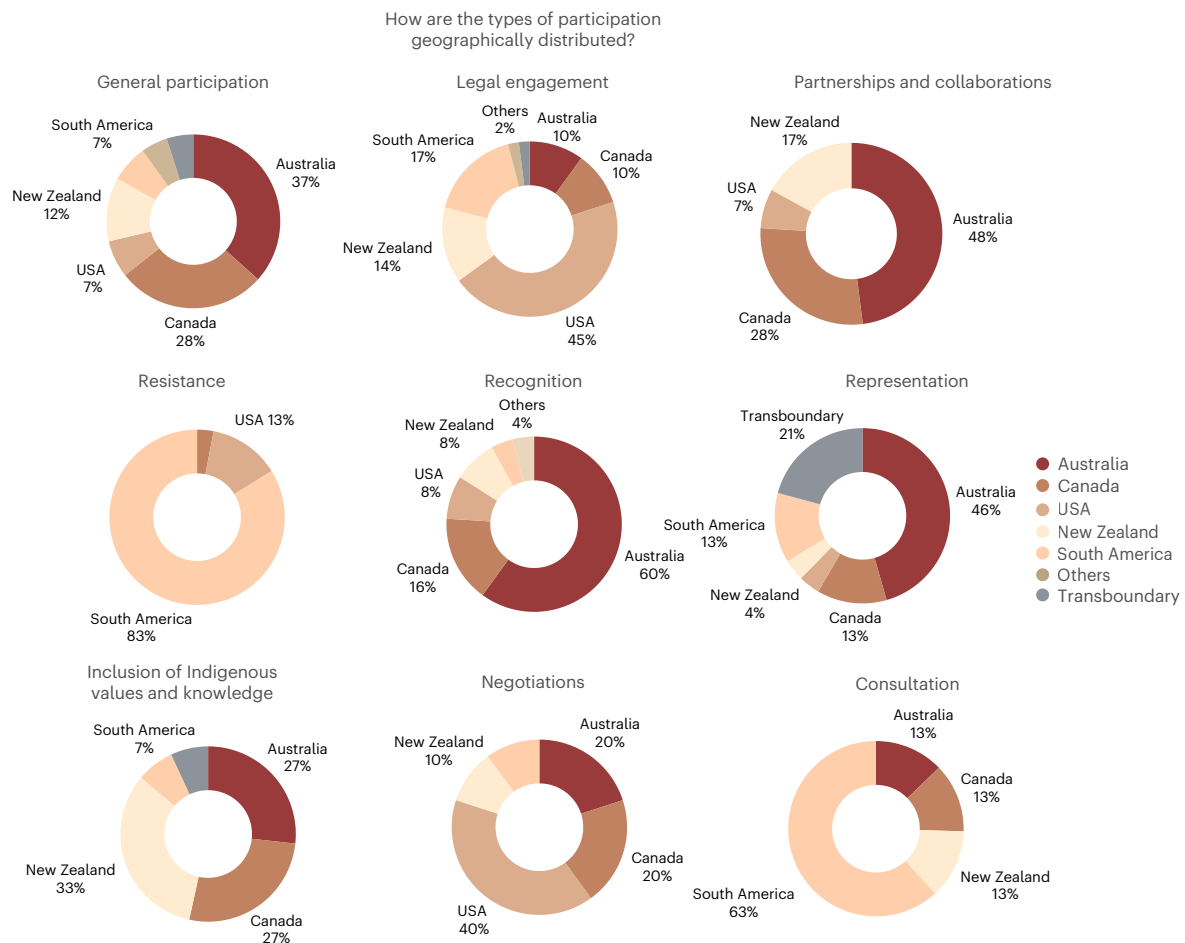


Fig. 3 | The types of participation in different geographies as a percentage of the total type. Percentages in this figure have been calculated as a fraction of the total of that specific type of participation.

Many journal articles highlighted popular resistance movements that arose in response to neoliberal water policies. For example in Cochabamba, Bolivia, Indigenous groups joined urban water users in protesting the government's attempt to privatize the drinking water sector^{119–123}. In Ecuador, Indigenous communities mobilized to advocate for Indigenous water rights^{120,121}. In addition, in South America, Indigenous communities also engaged in international forums including the Inter-American Human Rights Commission^{86,87} and the Latin American Water Tribunal⁵², for example, in Peru⁵², Guatemala⁸⁶ and Colombia⁸⁷.

Indigenous participation is diverse and dynamic, yet dominant colonial participation processes generally fail to include Indigenous values

In 24% of the case studies, participation was either unspecified or described as a dynamic, evolving process. For instance, First Nations engaged with the Government of Canada in a cyclical process of (in)action and response around the topic of safe drinking water^{17,124}. In other instances, multiple forms of participation could be found in the same example. For instance, the Ngarrindjeri Nation engaged with the state legally, in a policy engagement process, and in a partnership^{24,101}. Where more defined forms of participation were noted in the literature, Indigenous peoples commonly participated through legal engagement (23%), often around the issue of water rights and laws (22%). This was followed by resistance or political mobilization (16%) and collaborative processes and partnerships (16%).

Few studies considered Indigenous values and knowledge in the participatory process (19%), and if they did, it is unclear whether this was done in a manner that was not extractive, and whether Indigenous consent was present¹⁹. In addition, even fewer case studies evaluated Indigenous participation (15%). Despite a growing emphasis on recognizing Indigenous values in water governance processes^{6,10}, this review reveals that few processes do so.

Our study also highlighted several examples of 'created participation'^{125,126} whereby Indigenous communities created their own spaces to participate and engage with dominant or colonial governance structures. These 'created' forms of participation often took place as a response to the actions or decisions of the state or industry that negatively impacted Indigenous peoples, such as Chile's introduction of the 1981 Water Code which was met with widespread opposition and dissent from Indigenous peoples^{127,128}, as well as the construction of the aqueduct in Sonora, Mexico that negatively impacted Indigenous peoples, leading them to resist¹²⁹. In other instances, 'created' participation was a result of inadequate or ineffective 'invited participation'. For instance, the introduction of the Safe Drinking Water for First Nations Act in Canada was met with opposition from First Nations, due to lack of adequate consultation and concerns around treaty rights¹²⁴. This inadequacy of dominant or colonial processes of participation has been frequently mentioned in the literature^{29,30,130–132}. These created forms of participation also highlight that, to the extent that Indigenous peoples do participate in dominant or colonial water governance, it is quite often the result of an initial failure to engage them meaningfully.

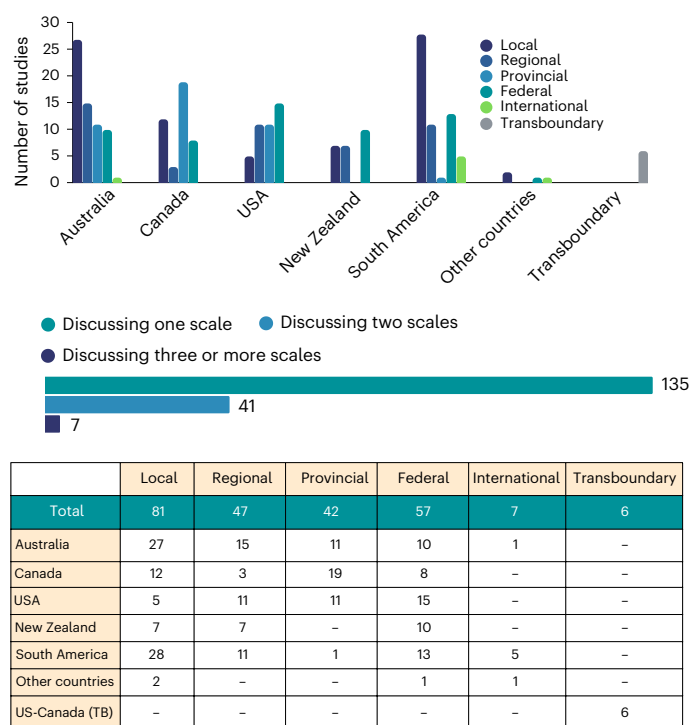


Fig. 4 | Scale of participation by geography. Distribution of studies examining Indigenous participation across different jurisdictional scales and regions. The bar chart and table show the number of studies with Indigenous participation described at local, regional, provincial, federal, international and transboundary level for the different countries or regions. The pie chart indicates the number of studies discussing one, two, or three or more jurisdictional scales.

Participation occurs at all scales, but unevenly studied, with participation at the global scale remaining underexplored

In this review, ‘scale’ refers specifically to jurisdictional or administrative scale. Investigating the scale of participation can provide insight into where power is concentrated and where actors are better positioned to influence decisions and outcomes^{51,131}. However, scale is a particularly complex and contested concept when involving Indigenous peoples. Indigenous peoples’ territories are not only diverse and variable³², but also may not align with the jurisdictional boundaries imposed by a colonial government. Moreover, while Indigenous peoples are often considered to operate at a ‘local’ level¹³³, Indigenous peoples are not always acting as a local entity. For instance, in Canada, First Nations function as governments that engage directly with the Crown on a nation-to-nation level³². At the same time, they also have a distinct relationship with certain territories, for instance in the Yukon, where they have a self-government agreement¹³⁰.

The review identified examples of Indigenous participation occurring at different jurisdictional scales, with collaborative processes and partnerships frequently reported at the local level and legal engagement at the federal level. The geographic context also influences the scale of participation. For instance, in South America, examples of Indigenous participation were often at the local scale, whereas, in Canada, examples more commonly highlighted engagement at the provincial level. In the USA, Indigenous participation was most frequently observed at the federal scale. Several case studies also discussed Indigenous participation taking place at multiple scales within the same study. Many of these case studies highlighted efforts of Indigenous peoples ‘scaling up’ from the local scale to elevate their concerns. For example, in Ecuador, Indigenous communities organized into the Federation of Indigenous Nationalities in Ecuador (CONAIE) to advocate for their water rights^{120,121}, while, in Guatemala, they formed a regional alliance called the Consejo Comunitario de Retalhuleu (CCR)¹³⁴. These trends

were also evident in Western settler-colonial contexts, for instance, in Australia, where Indigenous communities formed alliances such as the North Australian Indigenous Land and Sea Management Alliance, Murray Lower Darling Rivers Indigenous Nations and Northern Basin Aboriginal Nations⁷⁸.

Despite limited case studies discussing Indigenous participation at the international scale, the literature signals that Indigenous peoples have engaged in global water processes and were keenly aware of the opportunities that participation at higher scales offered them, even if not explicitly mentioned. Case studies, for instance, discussed Indigenous participation at several World Water Forums, leading to their own water declarations^{8,15,65,78}. In addition, studies from South America discussed how Indigenous communities recognized the limitations of local scales and decided to take their issues to international forums^{52,109,110}. While these studies provide evidence of Indigenous participation at the global scale, they lack sufficient descriptions around their participation. In the absence of this information, it is unclear how Indigenous peoples were able to influence decision-making at these global forums.

Although only six case studies discussed Indigenous participation in transboundary water governance, these were more thoroughly described than the examples of participation at the international scale. Most of these studies have highlighted how transboundary institutions have further entrenched settler-colonialism by excluding Indigenous communities from negotiations and decision-making processes^{57,58,64}.

A likely conclusion from the review is that, while Indigenous participation is taking place at the international scale, it is not being adequately studied and discussed. This has implications for our understanding of who has power and whose voice is heard at higher jurisdictional scales⁵¹. Global environmental forums have generally privileged states and multilateral organizations¹³¹, granting them greater authority and influence over discourse and norms surrounding water governance. Although there have been efforts to broaden participation in global spaces, Indigenous peoples continue to face challenges in influencing decisions at this scale⁹. In addition, global processes may overlook the localized and place-based knowledge held by Indigenous peoples, while privileging more generalizable and decontextualized knowledge^{45,131,133}. Looking at the example of Indigenous peoples’ participation in global climate governance forums, their participation has largely hinged on their respective national governments, which means meaningful participation can never be guaranteed due to historical marginalization¹³³. While this may also be the case in global water governance spaces, this review shows that Indigenous peoples create their own spaces for participation—even at the global scale, where they have resisted hegemonic water norms and produced their own water declarations.

Summary and research gaps

This systematic review provides an evidence-based review of how Indigenous peoples have participated and engaged in dominant water governance processes, including the jurisdictional scale at which they participate. We reviewed 226 peer-reviewed journal articles and extracted 183 case studies from 15 countries. Our study indicated that most Indigenous participation in dominant water governance systems occurs domestically, primarily at the local scale, with fewer documented instances of participation at the global scale. While the volume of articles on this topic has steadily increased since 2013, the geographic scope of the research remains limited, with over 80% of the literature originating from the CANZUS countries. There was a noticeable lack of literature from Africa and Asia, due in part to the review’s focus on English-language journal articles.

A considerable number of articles included in our review lacked information about the procedural aspects of participation, making it difficult to determine whether participation was meaningful and

Table 6 | Participation type and focus by scale

	Total	Local	Regional	Provincial	Federal	International	Transboundary
Total	183	81 (44%)	47 (26%)	42 (23%)	57 (31%)	7 (4%)	6 (3%)
Type of participation							
General, undefined participation or policy engagement	43 (23%)	23	9	7	7	3	2
Legal engagement	42 (23%)	10	15	14	25	2	1
Resistance and political mobilization	30 (16%)	23	11	3	11	2	–
Partnerships and collaborations	29 (16%)	16	12	6	4	–	–
Recognition	25 (14%)	6	1	10	8	–	–
Representation	24 (13%)	11	5	2	5	–	5
Inclusion of Indigenous knowledge and values	15 (8%)	4	4	4	5	1	1
Negotiations and agreements	10 (5%)	3	4	2	7	–	–
Consultation	8 (4%)	5	3	2	2	1	–
Thematic focus							
Water rights and laws	40 (22%)	12	10	14	24	1	–
General water and water governance	36 (20%)	11	8	7	9	4	2
Dams, mining and development projects	28 (15%)	18	8	5	5	2	–
Lakes or rivers	22 (12%)	11	11	1	6	–	3
Drinking water and source water protection	15 (8%)	9	–	6	9	–	–
Indigenous knowledge and cultural values	13 (7%)	4	2	3	4	–	1
Water quality and pollution	13 (7%)	4	3	5	6	–	–
Conservation and watershed management	12 (7%)	7	3	4	–	–	1
Environmental watering and flows	10 (5%)	7	4	1	1	–	–
Groundwater	5 (3%)	3	–	2	2	–	–
Floods	3 (2%)	2	–	1	2	–	–
Is there a description of the participation?							
Yes	101 (55%)	45	30	22	31	3	5
Is there an evaluation of the participation?							
Yes	27 (15%)	10	9	4	1	–	4
Are Indigenous values or knowledge considered?							
Yes	34 (19%)	12	11	6	11	4	1

equitable. Very few studies evaluated the participation. This highlights the need for research that evaluates participatory processes that involve Indigenous peoples, especially given the growing calls for enhanced participation of Indigenous peoples in certain spaces¹³⁵.

There was also insufficient discussion regarding scale and its implications for Indigenous participation, despite an implicit recognition of its importance. Further research is needed to explore Indigenous participation across different scales within the same contexts.

Finally, we recognize the limitations of this research. Our search was limited to two databases, included only English-language, peer-reviewed journal articles and relied on keywords that may have missed important literature from sources outside of indexed journals and other parts of the world. Future reviews could broaden this search to include books and grey literature, incorporate scholarship from multiple languages and use locally contextualized terms or names of specific Indigenous nations or tribes.

Methods

Systematic search methods minimize bias in the retrieval and review of academic and non-peer-reviewed articles^{136,137}. Such an approach enables critical examination of how Indigenous peoples participate in water governance across different geographies and scales. For this review, we followed well-established guidelines for systematic

reviews¹³⁸ and drew on relevant studies exploring participatory environmental governance approaches¹³⁹ to investigate how dominant systems of water governance have engaged and included Indigenous peoples. Dominant water governance in this review refers to colonial, post-colonial or neoliberal governance systems that are imposed by the dominant society. Our overarching research question for the review is:

How have Indigenous peoples participated, engaged with or been included in dominant water governance processes?

Thus, we are specifically examining case studies of Indigenous interactions with the state, industry or other actors in dominant water governance processes. In doing so, we analyse the water governance issues in which Indigenous peoples participate and the jurisdictional scales at which this participation occurs, as the scale of participation may determine the influence an actor has on water governance priorities and, ultimately, on outcomes^{45,51,131}.

Positionality

All authors are non-Indigenous allies working on issues of environmental justice and equity. Aware that our positions influence interpretation, we engaged in ongoing critical reflexivity throughout the review process. Our aim is to contribute constructively by examining

how participatory approaches in dominant water governance fall short of inclusivity while affirming Indigenous peoples' rights to self-determination and self-governance.

Definitions and key concepts

Several definitions for the term water governance exist¹⁴⁰. Building on Emanuel and Wilkins (2020)¹², we define water governance as the processes, principles and institutions involved in decision-making about the use, management, conservation and protection of water. The scope of this review is limited to freshwater systems, including surface water and groundwater, but excludes ocean, coastal and marine governance.

For Indigenous peoples, we adopt the definition put forward by José Martínez Cobo, the United Nation's Special Rapporteur, where an Indigenous person is defined as "one who belongs to these Indigenous populations through self-identification as Indigenous and is recognized and accepted by these populations as one of its members"¹⁴¹. Thus, this review specifically considers examples where communities have been specified as Indigenous, and not where populations are referred to as local communities, tribes or ethnic minorities.

Participation is a broad concept, often understood as "a process where individuals, groups and organizations choose to take an active role in making decisions that affect them"¹⁴². For this review, we adopted a narrower and operational definition that would enable consistent screening and coding across a large and heterogeneous body of literature, as well as to allow for replication. Accordingly, we defined participation as a process involving two or more distinct actors interacting together in a water governance process. Thus, our review focuses exclusively on instances of Indigenous participation that entail engagement with external, non-Indigenous actors, such as the state, industry or other third parties, specifically in the context of water-related decision-making. This definition includes Indigenous-led participatory processes that involve interaction with external actors, but it excludes cases of Indigenous self-governance or internally driven decision-making or management that occur independently of external engagement. A broader definition of participation would not only have expanded the scope but made it challenging to systematically analyse articles with consistency. That said, we recognize that Indigenous actors shape water governance in ways that exceed the boundaries of our operational definition of participation.

Scale could refer to a temporal, spatial, hydrological or jurisdictional dimension, or to levels within the dimension^{54,143,144}. The literature around scale is rich with discussions around the multiplicity of definitions and interpretations of scale^{143–145}, as well as the appropriate and legitimate scale for governance¹⁴⁶. In our review, we define scale as the jurisdictional level used by states and governments for administrative purposes. We focus on six scales: local, regional, provincial, federal, international and transboundary.

Search strategy

The search was conducted on 26 November 2023, using two main research databases: Scopus and Web of Science. Key search terms were employed using a Boolean search string to search English language journal articles that included these terms in their title, keywords or abstracts (Table 1).

The search resulted in a total of 1,229 results from Scopus and 587 results from Web of Science. After removing duplicates, 1,341 unique records remained. These were examined to assess whether well-known and foundational articles had been included, and a small number of relevant articles not captured by the search were subsequently added manually.

Screening and eligibility

The articles were screened at the title and abstract level against specific inclusion criteria (Table 2). Abstracts had to be focused on water governance, and explicitly mention Indigenous peoples or their

knowledge. Screening was primarily conducted by one author (L.K.), with a random subset of 10% of the journal articles ($n = 134$) checked between two secondary reviewers (A.M.C. and S.W.) at the title and abstract levels. After discussion, kappa scores reached higher than 0.7, suggesting substantial agreement¹⁴⁷.

A total of 523 journal articles proceeded to full text to be assessed for eligibility. Journal articles that presented a clear example of Indigenous peoples' participation, engagement or response to dominant water governance processes were included. Articles focused purely on Indigenous water management and self-governance, Indigenous water relations and Indigenous ontologies with no example of interaction with an external actor were excluded. A decision tree was developed to support consistent article selection (Supplementary Section 7).

Coding and data extraction

After reading 523 journal articles, a total of 223 articles were considered eligible. In addition, we manually included three additional articles that met eligibility criteria. In total, 226 articles were considered for coding and data extraction. As several journal articles referred to the same case study, a total of 183 distinct case studies were extracted. The flowchart outlining the method and steps for the systematic review is presented in Fig. 1.

Coding for both papers and case studies was done using a mix of both inductive and deductive approaches depending on the variables¹⁴⁸. Double or multiple codes were allowed for several variables. Table 3 presents the coding scheme. The analysis took place at the case study level where participation types, themes and jurisdictional scale of participation were explored.

The participation processes in each case study were coded using an inductive, open coding approach. These codes were then consolidated into a participation type based on adopted definitions (Table 4). This was an iterative process, because many existing typologies for participation did not capture the range of participatory processes encountered in the case studies. Case studies that suggested multiple forms of participation were accordingly double- or multicoded. Notwithstanding the limitations of using categorical codes for complex participation processes, the coded studies did reveal important trends in how Indigenous participation is represented and discussed within the literature.

Case studies were coded by individual country. However, for presenting results, some were grouped into broader regions, for example, several countries were consolidated under 'South America'. Three standalone studies from Japan, Sweden and New Caledonia were grouped into the 'Others' category. Results were presented across the following geographic categories: Australia, Canada, USA, New Zealand, South America, others and transboundary. Although all transboundary cases focused on the USA–Canada border, they were treated as a separate category to avoid diluting the results.

Case studies were also coded for the jurisdictional scale at which participation took place. For instance, if an Indigenous nation engaged with the national government, it would be classified as Federal. Case studies where participation took place in multiple localities or states would be classified as Regional, such as the Standing Rock movement in the Dakotas^{12,65}. In total, there were six codes for scale: local, regional, provincial, federal, international and transboundary. Several case studies had multiple scales.

Additional variables for which case studies were coded included whether the case studies were described in detail, whether they were evaluated and if Indigenous values, norms or methods were considered in the participation process. These variables were coded as either 'yes' or 'no'. This last category is separate from the studies where the participation type was coded as 'Inclusion of Indigenous knowledge and values', because there were several studies with different types of participation, such as collaboration, that may have considered Indigenous values and norms.

Limitations and scope

Despite using a systematic approach to review literature and extract case studies of participation, we recognize the limitations of our research. The review was limited to English-language, peer-reviewed journal articles indexed in major bibliographic databases. This decision may have led to the omission of important case studies, documented in sources outside of indexed journals and studies from non-English contexts.

Conceptually, we adopted a very specific definition of participation, focusing only on studies in which Indigenous peoples were involved in dominant water governance systems and engaged with external actors. This improved conceptual clarity and reproducibility but excluded participation occurring within Indigenous governance systems or forms of self-governance without external engagement.

Our keyword strategy did not include the names of specific Indigenous groups, such as the Saami, as we anticipated that terms such as ‘Indigenous’ and ‘First Nations’ would capture a wide range of populations. We also made a deliberate decision not to conflate the term ‘Indigenous’ with other terms such as ‘local communities’ or ‘ethnic minorities’, but this choice may have inevitably excluded studies from contexts where certain groups are not formally recognized as Indigenous or where there are challenges to identify and define who is Indigenous¹⁴⁹.

Future research could consider broadening the review by drawing on books and grey literature, incorporating scholarship in multiple languages and considering studies that adopt more locally contextualized Indigenous identifiers, while attending carefully to how these terms are used politically and culturally.

Data availability

Data used to derive the results are available via figshare at <https://doi.org/10.6084/m9.figshare.27889074> (ref. 150). Source data are provided with this paper.

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L.K. and A.M.C. conceived the ideas; L.K. collected the data, conducted the analysis and led the writing of the paper; A.M.C. and S.W. provided support on verifying the screening by screening and comparing a subset of articles. The final paper was prepared by L.K., with ongoing guidance and mentorship from A.M.C.

Competing interests

The authors declare no competing interests.

Additional information

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